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ABSTRACT

The effects of industry and technology are important in our society, and industrial arts in public schools is undergoing evaluation and curriculum revision in order to guide youth toward choosing and preparing for an occupation. The "manufacturing" approach used in the guide is suggested as one way toward the integration of students with their industrial culture. A brief first section contains the rationale, general objectives, and overview. The informational units which follow are designed as self-study guides for those teachers with a limited background in industrial manufacturing and cover: aspects and history of manufacturing; industrial functions; management and industrial organization; and production tooling, and include evaluation and resource suggestions. The guidelines for package implementation, developed by student teachers, can be employed for 6-, 10-, or 20-week programs. They include manufacturing concepts and student activities, implementation analysis, and possible problems and their solutions for a simulated manufacturing business. A sample mass production unit, designed for mass production techniques and special tooling, provides information and suggested activities. The final section was developed for student use and contains guides for: tooling; production; organization of a compnay; research and development; finance and control; personnel administration; and marketing. (JB)

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A Comprehensive, informational, instructional guide for

The Implementation of Manufacturing

in the Public School

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PREFACE AND ACKNOWLEDGEMENTS

This instructional package is the result of the successful implementation of "Manufacturing" or the "Corporate Simulation Approach" to teaching Industrial Arts in four public school pilot student teaching centers during the Fall, 1971. The field testing of pilot programs in Industrial Arts is an optional student teaching assignment conducted by the Department of Industrial Arts and Technology's Industrial Arts Field Services. This cooperative college/public school program is now in its second year of operation.

During the curriculum development phase of the program the student teacher participants designed and developed this instructional system. The material included is a composite of their combined experiences and resources based on their respective implementations of "mini" manufacturing programs in the pilot centers. They view this systematic arrangement of informational units, instructional guidelines, directives, strategies, resources and self-study modules for students as being invaluable in directing them through the successful operation of a simulated enterprise.

The participants and staff of the Manufacturing Pilot Program thank the cooperating consultants, building principals and students in each of the pilot centers for making the field testing of the manufacturing approach possible. Appreciation is also expressed to Miss Elizabeth Noetscher for her typing services in the preparation of the package.

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TABLE OF CONTENTS

Preface and Acknowledgements i
Participating Personnel ii
Table of Contents iii

I. INTRODUCTION

- A. Rationale 2
- B. Objectives 2
- C. Overview 3

II. INFORMATIONAL UNITS

- A. Introduction 6
- B. Manufacturing in Industry 7
- C. History of Manufacturing in the United States 11
- D. Industrial Organization and Management 13
- E. Industrial Functions
  - (1) Personnel 22
  - (2) Research and Development 25
  - (3) Finance and Control 31
  - (4) Production 43
  - (5) Marketing 48
- F. Production Tooling 51
- G. Evaluation 56
- H. General Bibliography/Resources 66

III. GUIDELINES FOR PACKAGE IMPLEMENTATION

- A. Implementation Analysis 74
- B. Manufacturing Concepts and Activities 83
- C. Possible Problems and Solutions 95

IV. SAMPLE MASS PRODUCTION UNIT

- A. Introduction 99
- B. Equipment and Tools Needed 100
- C. Wood Spinner Top Drawings 101
- D. Tooling Drawings for Top 103
- E. Process Flow for Top 108
- F. Metal Candle Holder Drawings 109
- G. Tooling Drawings for Candle Holder 110
- H. Process Flow for Candle Holder 115

V. STUDENT GUIDES/SELF-STUDY MODULES

PART I

INTRODUCTION

J. Stephani

Rationale for "Manufacturing" in Industrial Arts

Manufacturing as a method of teaching industrial arts is an action packed program of excitement designed to meet today's needs of today's action-oriented youth. Industrial arts in our public schools is experiencing a much-needed evaluation and redirection as all of education is involved in a strenuous, but timely period of accountability. Throughout our elementary, junior, and senior high schools, all academic and practical disciplines are emphasizing curriculum content and methods that put the student right in the center of the learning process, both literally and figuratively while providing experiences that enable him to interact with his world. These trends toward real educational involvement with the culture are producing well informed youth, better prepared as a result of their general education experiences to live in a society for which they will ultimately assume responsibility. The effect of industry and technology on the lives of today's youth grows increasingly important. Youth are consumers; they buy and use the products of industry. They live in an economy second to none; the result of the progress of American industry. They are subject to the problems of industry. They are curious about this technology that places men on the moon and cures once incurable diseases. These youth are the future industrialists, the researchers, the engineers, the stockholders.

Industrial arts is the only subject in our general education curriculum devoted to giving youth the opportunity to study and become actively involved with the tools, machines, processes, products, and problems of American industry, thus acquainting them with the technological society in which they live and will ultimately make their living. Traditional industrial arts programs, although emphasizing the tools, the processes and the skill aspects of industry, are narrow in scope, doing very little to interpret industry as a major force in the culture. Needed is a program of studies that treats equally the human, operative and productive dimensions of contemporary industry. Such a program would involve students, through simulation and role-playing, in the organizational and management phases of industry as well as the familiar technological phases. The "manufacturing" approach to teaching industrial arts is one way of accomplishing this total integration of the student with his industrial culture.

Objectives of Manufacturing Program

Consistent with what has been deemed the most inportant general objective of Industrial Arts, briefly stated, to give students an understanding of industry, this manufacturing course is designed to give boys and girls an exposure to, and contact with, the structure and operation of typical manufacturing industries. The general objectives of this course would include the following:

A. To provide students with an understanding and appreciation of industry, its organization and operation, including the interaction of money, manpower, materials, and machines to produce goods and services.

B. To enable students to accomplish the above through a corporate simulation resulting in the establishment and operation of a class company.

C. To provide a climate for individual expression as well as team work a sense of belonging, role-playing, and the development of cooperative attitudes.

D. To provide opportunities for problem solving.

E. To provide opportunity for students to understand mass production, its complexities and techniques, as a major element of manufacturing industries.

F. To provide skills in specific machine and tool operations, planning, designing, construction of models, prototypes, jigs, fixtures, and templates.

It should be noted that specific behavioral objectives, stated interms of expected learner outcomes are identified under Manufacturing Concepts and Activities in Section III, Guidelines for Package Imprementation, of this package.

Overview of Program

The manufacturing approach to Industrial Arts is valuable because it swings the pendulum to include the abilities of the student who normally avoids the labs because his manipulative skills are low or because he feels his academic skills will not be challenged. His abilities to think, create, lead others, draw, organize, sell and report are vital to the manufacturing program.

Although there are five distinct phases to the manufacturing program, no arbitrary time limits have been identified. Depending on how long you choose to run the manufacturing program, that is, 6 weeks, 10 weeks, or more, you will want to assign an appropriate amount of time to each phase. This is explained further in Section III.

Phase A - Orientation and Organization deals with promoting student interest in the program and establishes organization procedures for the student company.

Phase B - Product Generation follows and encompasses the span from idea formulation through prototype development.

Phase C - The Pre-Production activities are many and varied. All departments (engineering, marketing, finance and control, personnel, production) now begin to function and will continue to function into phase E.

Phase D - Production puts to the test the organization and planning that have preceded it, that is, actually producing the product.

Phase E - Post-Production handles company liquidation and a review and evaluation of company operation, plus opportunities for enrichment with related lessons, films, and outside speakers.

Overview of Instructional Package

This instructional package will enable you, the instructor, to develop a substantial background and familiarize yourself with alternative methodology necessary to implement a manufacturing activity, unit, or course, depending on your preference, in your school program. It is designed to provide maximum flexibility while at the same time giving ample structure and direction for insuring a logical, organized, and successful manufacturing experience for your students.

There are four main sections to the manufacturing package:

Informational Units - Designed for industrial arts instructors who have limited background in actual industrial manufacturing, these units can be used as a self-study guide. The units cover selected aspects of manufacturing, plus evaluation techniques, and a list of selected readings and resources.

Guidelines for Package Implementation - This section gives a detailed explanation of basic manufacturing concepts and their respective student activities, implementation analysis (an overview of the complete corporate simulation), and possible problems, with solutions, that one may encounter in this manufacturing venture.

Sample Mass Production Unit - Motivating students can be an extremely difficult task. This unit is designed to do just that, motivate students. A simple mass production exercise is given with all the necessary information, including product and tooling drawings, enabling you to construct the jigs and fixtures and set up the activity with relative ease and speed. Students will then be able to get an idea of what mass production is and have a good understanding of production tooling for their own company needs.

Student Guide/ Self-Study Modules - The manufacturing approach includes the teacher in a very active role of a general consultant. To help free the teacher for this task and to promote individual student growth, comprehensive Student Guides/Self-Study Modules have been developed for student use. Hint: You will also want to read them. They are written at the class company operational level for your students. Each module provides respectively for each department, role-playing opportunities, sample forms, explanations, procedures, directions, and other helpful aids for your student industrialists.

PART II

INFORMATIONAL UNITS

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INTRODUCTION

The following informational units are intended to acquaint the instructor with the various aspects of manufacturing.

The manufacturing units covered in this section of the package are manufacturing in industry, the history of manufacturing, industrial organization and management, functions of industry and production tooling, plus a unit dealing with different evaluation techniques, and a unit composed of a list of suggested outside readings.

With or without a manufacturing background the instructor should be able to draw from these instructional units, the necessary information to present to his students a meaningful manufacturing experience.

As a means for evaluating the student the teacher may use ideas from the evaluation unit or any of his own techniques.

Any additional information needed may be obtained from resources listed in UNIT G Much of the material in these informational units will be directly applicable to your classroom instruction. The entire package has been xeroxed so that thermal spirit masters may be used to produce class handouts or transparencies for instructional use.

UNIT A - Manufacturing in Industry

The manufacturing concept is a very complex and immense part of today's industry. The basic interpretation of the word, manufacture, is to manipulate a part, to "create," form, or fabricate one substance into a more useful object. Manufacturing began with cavemen, then craftsmen (or guildsmen), and now the word is usually associated with our present day assembly lines which came about, as explained in the History of Manufacturing in the U.S. (Unit B) during the Industrial Revolution. The assembly line is the last phase of a manufacturing system. Today's manufacturing in industry has uniformly taken the form of mass production in order to meet standards, increased demand due to population, uniformity of products, etc.

Assembly Line

The assembly line did away with the basic idea of a craftsman as we know it. Mass production of parts has brought about increased standardization and specialization. These aspects led to interchangeability of components. Our auto industry is a good example of this: some components may be made in Lansing, Michigan, others in Buffalo, New York, yet the entire car will be assembled in Montreal, Canada. This is only possible through the interchangeability of parts.

This standardization and specialization is not held only to components. The multi-talented craftsmen no longer can mass produce to today's standards. Working in today's industry, each individual has a job, he is a specialist at this job and that is all he does. This specialization of manpower also brought about wage standardization, production scheduling, cost standardization, and time studies. A time study is: Normal time of the performance of a task = Base time x the performance rating of the specialist or machine that specializes in that operation.

In order to accomplish this uniformity of parts we indicated special tooling had to be incorporated. The production of these special tools still requires craftsmen of certain skills. These craftsmen, known as tool and die makers, make special tools and equipment to ensure standardization of component parts. Each part has to be precision made to a specification and must pass a quality control inspection. Naturally, this process will also speed up production time of each component part.

All of the above production aspects and the special tools used in the actual production will be dealt with under Unit F - Production Tooling. Please refer to these for further details.

Plant Layout

Let us first look at the three possible means of securing a plant:

1. Buy or lease on a new site.
2. Additions to the present site.
3. Construct a new facility at an old site or a new site.

A. Reasons for a new facility.
  1. new product (new industry)
  2. new product line (added to a present industry)
  3. rapid increase of demand (more facility to supply for it)
  4. lease runs out on present plant
  5. present plant becomes a condemned structure
  6. source of raw materials or supplies has changed
  7. tax rates
  8. labor conditions
  9. inventory
    a) enabling buying of "package" raw materials at lower cost.
    b) enabling stockpiling of finished product for rapid fulfillment of orders.

B. Site factors (feasibility studies)
  1. location of customers
  2. source of raw materials
  3. transportation
  4. labor costs
  5. availability of skilled labor
  6. power
  7. climate
  8. taxes
  9. water
  10. zoning
  11. topography
  12. feasibility of expansion

C. Company profile

The profile of the manufacturing company will have a tremendous effect on how many outside factors will be pertinent.

Various companies may:
  1. convert raw materials to standard stock (Bethlehem Steel)
  2. be a component assembly plant (Tonawanda, N.Y., division of General Motors)
  3. fabricate component or finished products from standard stock (ALCOA, Cleveland, Ohio)
  4. be a full process from raw materials to finished product (ALCAN, Oswego N.Y. plant)
  5. incorporate many different products (Kodak, Rochester, N.Y.)

D. Building layout

Building layout is usually decided upon by architects who will produce floor plans which correspond with the smooth flow of the product through its various operations. (Flow charts are very similar) Large industries separate operations into departments. (example– blanking would be in a different department than a rolling or forming operation).

Good building layout will:
  1. make economical use of floor space
  2. reduce cost of equipment
  3. reduce handling of materials and parts
  4. increase the use of men and machines
  5. ensure safe and comfortable working conditions

E. Lead time

Lead time is the total time it takes to prepare a mass production line for a product, including design, planning, tooling up, etc.[2]

After a plant has been built and our product has been decided upon, before we get to our mass production stage some pre-production activities must occur. For a detailed report on these activities please refer to Units E and F - the functions of industry and production tooling, respectively.

To understand our manufacturing system (orderly way of making things), you should think of it as having three main parts: 1) input, 2) process, 3) output. Naturally, this is much more complex, as to work well, the system must be managed (planned), organized, and controlled. However, to benefit the students overall view, perhaps the following would be beneficial.[1]

Input

Input is whatever goes into the manufacturing system to produce a complete saleable product. These are six major inputs into the manufacturing system:

1.) Natural Resources: vegetable, mineral, animal
2.) Financing: money (cash or credit)
3.) Capital: buildings, machines, equipment, tools, etc.
4.) Energy: water, wind, fuel, electricity, sun's radiation, and atomic energy
5.) Human Resources: skilled manpower, labor pool
6.) Transportation: availability of waterways, rail, highway, or air shipment of raw and finished materials

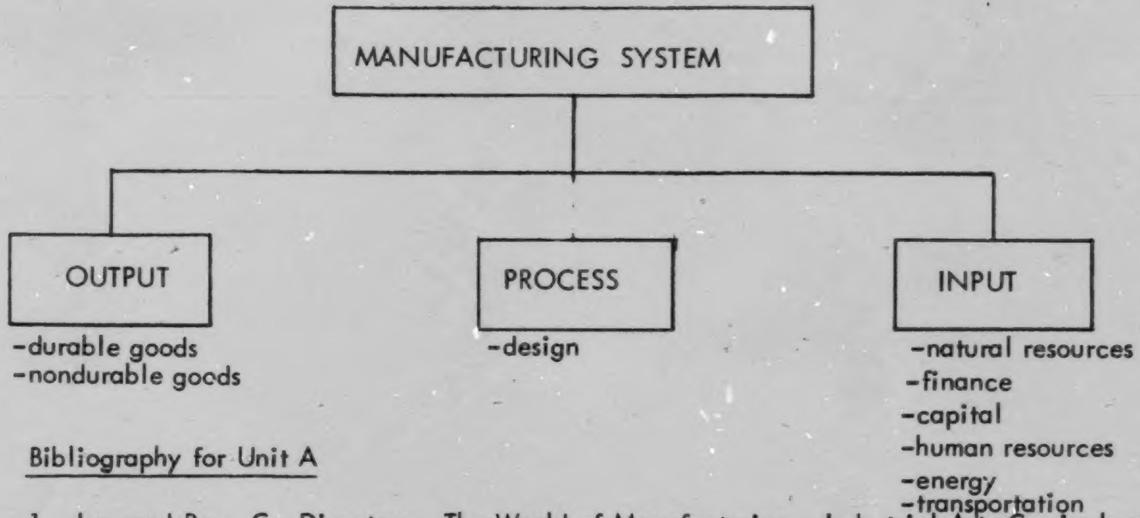
Process

The change of raw materials to finished products in the most efficient and inexpensive way possible to attain uniformity. Manufacturing process in industry today has uniformly taken over the mass production aspect. Mass production is a complicated process. It involves many workers, many machines, and a great deal of money (called "capital"). For further explanation, please refer to Units D, E and F, of this informational section.

Output

Output is the end product of a manufacturing system. The United States government has a system of classifying manufactured outputs into two categories:

Durable goods; products that will last at least three years
Nondurable goods; products that probably won't last three years


MANUFACTURING SYSTEM
OUTPUT
-durable goods
-nondurable goods
PROCESS
-design
INPUT
-natural resources
-finance
-capital
-human resources
-energy
-transportation

Bibliography for Unit A

1. Lux and Ray, Co-Directors. The World of Manufacturing. Industrial Arts Curriculum Project. Bloomington, Ill.: McKnight & McKnight.
2. Gerbracht and Robinson. Understanding America's Industries. Bloomington, Ill.: McKnight & McKnight.

UNIT B - History of Manufacturing in the United States

Early American industries consisted of craftsmen who made wares by hand. These wares were either sold or traded to others. Quality of the items and the rate at which they were made depended on the skill of the craftsmen. Each item had to be made separately with its individual parts being fitted by hand, requiring much time and labor. This resulted in a low output of goods at a high cost.

Industrial Development

During the late Eighteenth Century, the Industrial Revolution brought about vast changes in the manufacture of goods. As machines were invented to do work done by hand, the cost of items decreased as production increased. With this new low cost the demand for products increased greatly. This, in turn, created a need for new and better machines. Soon factories developed and the skills of craftsmen combined with machines to produce items in large quantities. As production increased it was hindered by the machines in use, which needed the force of manpower or falling water to run them.

The revolution started in England, in the textile industry, with a change in the spinning of thread and weaving of cloth. A new loom was invented, powered by an engine, which could weave faster than by hand. This application of power - driven machinery then spread slowly to other European countries and the United States.

With the invention of the steam engine, by James Watt in 1769, factories could be located almost anywhere where raw materials were available.

The Industrial Revolution brought these changes to manufacturing:

1. Products made with machinery.
2. Running of machines by engines.
3. Making of products in factories.

Mass Production

"A system of manufacturing called mass production developed slowly. Mass production is the making of identical parts in large quantities. The products are uniform in quality and cost." (4, p.259)

Eli Whitney is credited with introducing mass production in the United States. In 1798 he established a factory to produce muskets for the government. Using jigs and fixtures to insure standardization, Whitney produced muskets that had interchangeable parts. These parts could be produced independently and assembled later.

As Whitney's methods of manufacturing were used by other ingenious Americans, new and better ways of mass-producing products were devised.

In 1908 the "moving assembly line" was introduced by Henry Ford. By moving the work to his workers instead of vice versa, he eliminated much wasted time and motion. It was now possible to manufacture Model T's more rapidly and at a lower cost per unit. As the cost was reduced more people were able to buy cars. As the demand for automobiles increased, more and better machines were used, which in turn increased quality and production. "This cycle of increasing production and lowering of cost has caused the auto

2

industry to grow rapidly." (4, p.258)

Specialization of labor is used in factories where items are produced by mass production. Different operations to be performed on a part or item are divided among workers. Each worker is then trained for that specific operation. Using this system (division of labor), workers become proficient at their jobs since they were required to learn only a small portion of the entire manufacturing of a product.

Post-Industrial Revolution

"Since World War II, numerous changes have been made in the machines, methods, and techniques. This period in our industrial history is considered as the beginning of an era called automation." (4, pp. 259-260)

Machines are now being made that are fully automatic. These machines eliminate the monotonous and unskilled work done by men. Many machines are designed to perform various operations, plus transfer the work from station to station, (transfer machines). Even though many unskilled jobs are taken away, many people will have to be trained to control and maintain these machines and other equipment.

For a more detailed explanation on the history of manufacturing in the United States, refer to the following references, from which much of the above material was taken.

References:

1. Kettering, Charles Franklin, and Allen Orth. American Battle for Abundance - A Story of Mass Production. Detroit, Michigan: Public Relations Staff of General Motors. 1955
2. The Evolution of Mass Production. A Ford Motor Co. Production. Dearborn, Michigan: Published by Educational Affairs Department, The American Road. 1956.
3. Lux, Donald G. and Willis E. Ray. The World of Manufacturing. Industrial Arts Curriculum Project. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1971.
4. Smith and Maddox. Elements of American Industry. Bloomington, Ill.: McKnight & McKnight Publishing Co. Pp. 257-261.

UNIT C - Industrial Organization and Management

Ownership is defined as the right of possession, control and disposal; having legal title to property. There are a number of types of ownership. The three we will be interested in are a single proprietorship, a partnership and a corporation.

Proprietorship - A proprietorship is a single owner-operated firm in which one person owns, manages and works that firm. A few of the good points of a proprietorship are the concentration of authority and responsibility on a single individual. The owner does not have to depend on others when making decisions. Also there is a simplicity of legal matters and there are no corporate taxes. A proprietorship is not all beneficial however. Certain disadvantages involved are the lack of capital and fund raising ability possessed by a single individual. Perhaps this one person lacks a proper managerial ability as well and can not operate his firm efficiently. Another important factor is the presence of unlimited liability. If an employee is hurt due to negligence or through the fault of the company only one man is held responsible.

Partnership - A partnership is a form of business organization in which two or more persons carry on a legal business. This type of ownership also has specific advantages and disadvantages. Some of the advantages are that there are, again, no organization taxes. A partnership is easy to form and with two or more people in charge there is more capital available. More credit is available to the firm and there is more than one person held responsible for the firm's actions. A few or the disadvantages are as follows. Each partner has unlimited liability for debt. All of the profits are shared and shared alike. Finally one partner can commit the firm and other partners without their knowledge.

Corporation - A corporation is a group of persons who are organized to carry on a business or a particular kind of work and who are authorized by law to act as a single person. The advantages are: there is a greater capital available to a corporation, the owners are not liable, no individual bears the entire load and the corporation never dies. The disadvantages are the red tape in getting anything done plus the communication problem of not knowing what the other owners are doing.

The type of ownership which is best for your needs varies with the situation. For example the size of the business, the type of product to be manufactured, the amount of resources necessary and the number of owners involved all have a distinct influence on the type of ownership needed. In a school room the corporation type of ownership has worked out quite well and seemed very beneficial for the students. No matter which type of ownership is finally decided upon there must be an organizational structure within the firm to maintain efficient operation.

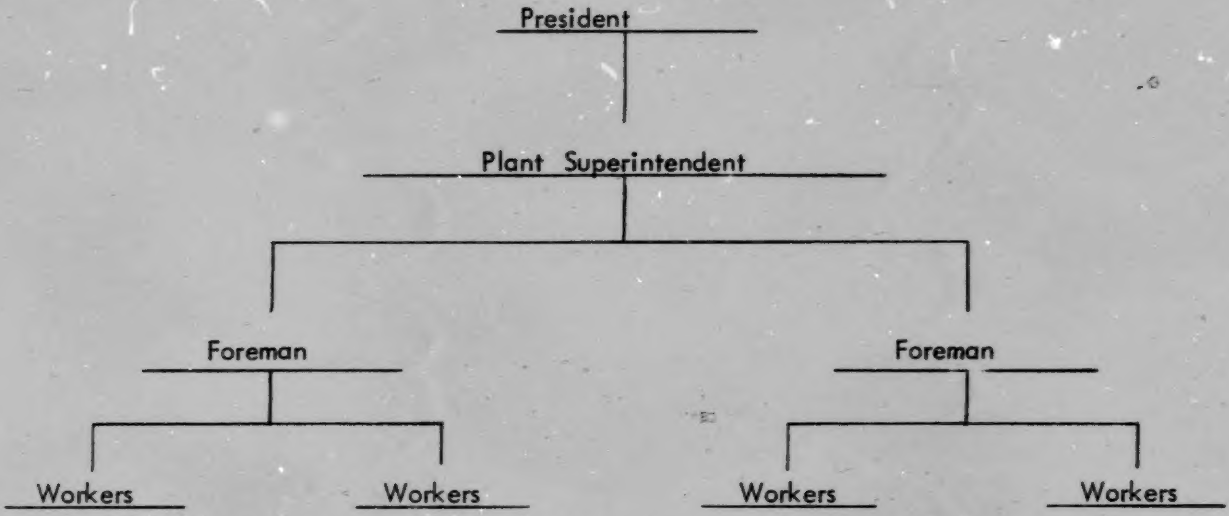
Organization has the primary purpose of coordinating and controlling the activities of a company. It is the process of combining the work of individuals with the facilities necessary for its execution. Also organization integrates the various jobs of the company into an effective framework to provide for accomplishment of the company's objectives. Any organizational authority should be centralized so it will give the best possible overall performance. Many types of organizations for businesses exist. We will look at three specific ones and they are simple Line Organization, Functional Organization, and Line and Staff Organization.

Line Organization is the simplest form of structured organization. It is a framework on which to build a more complex organization as the need arises. It has a direct responsibility and control from the president to the plant superintendent to the foreman and then to the workers. SEE DIAGRAM. A few of the important facts about Line Organization are:

1. The president handles all management problems.
2. It is the oldest and simplest method of organization and it is used by most small businesses.

Some disadvantages are:

1. Specialization.
2. Dictatorial operation.
3. Seldom any training for leader replacement.
4. Heavy reliance on subordinates.



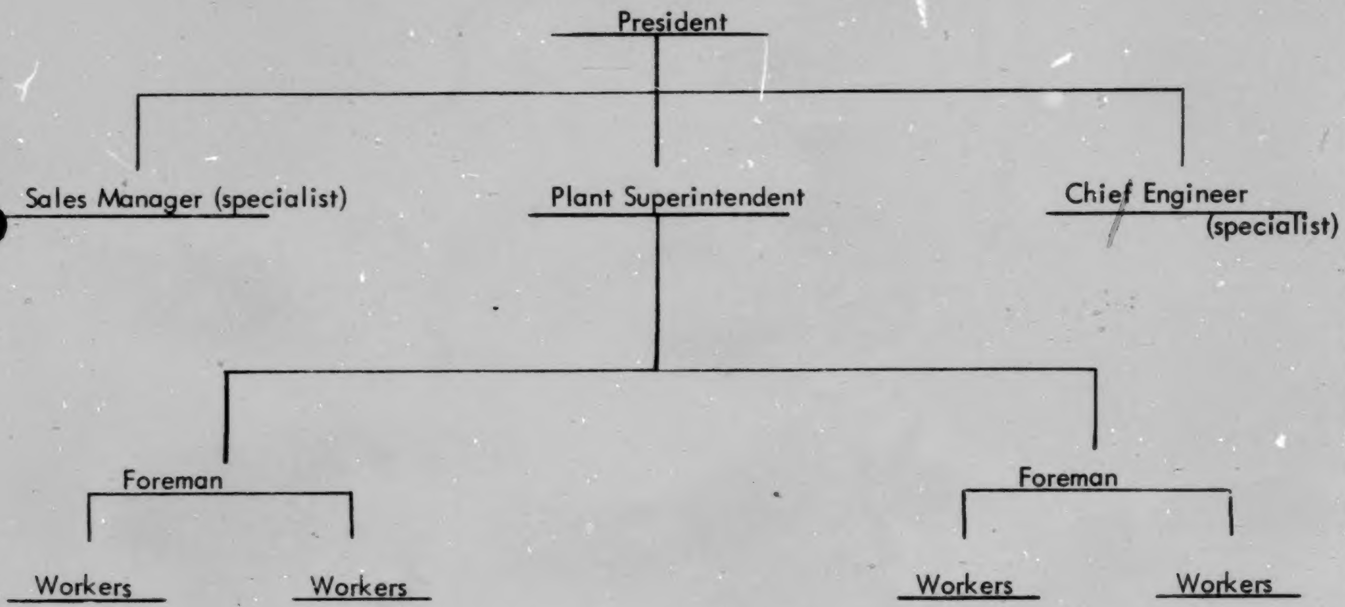
LINE ORGANIZATION

Functional Organization is a system where a group of specialists boss the workers. It removes the staff specialist from an assisting capacity to one of authority and responsibility for supervision and administration of the specific function.

1. Each worker is responsible to more than one boss.

2. Expert advice is always available to workers.
3. Advantages.
   - A Individual proficiency and specialization.
   - B Employee skill is developed more highly.
   - C Overcomes inefficiency of a one man control.
4. Disadvantages.
   - A Difficult to establish and maintain.
   - B Change in personnel may cause instable organization.
   - C A series of specialists in charge.
   - D Locating and fixing responsibility is difficult.
   - E Responsibility and authority may overlap.

Line and Staff Organization is similiar to Line Organization except for the addition of some specialists. SEE DIAGRAM.

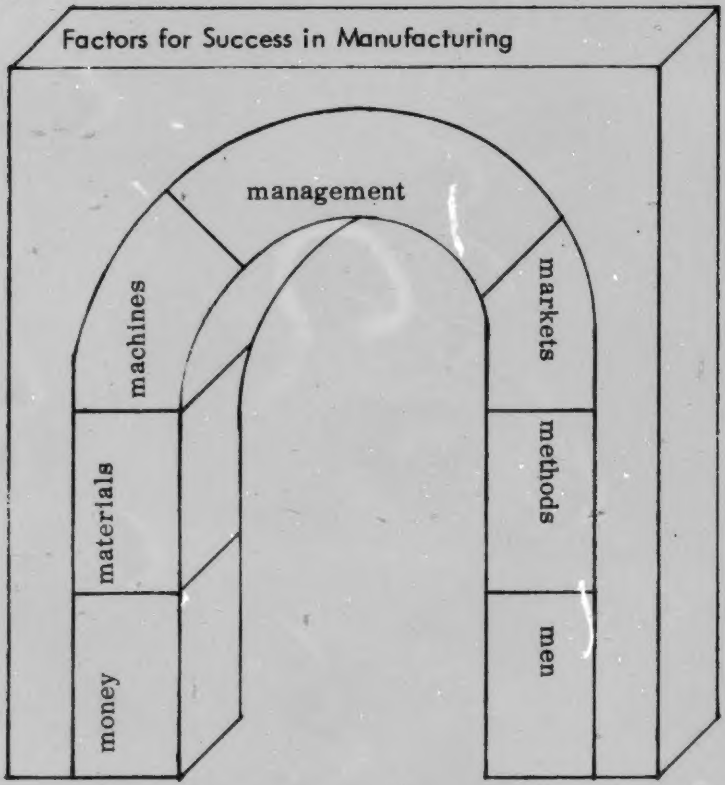

President
Sales Manager (specialist)
Plant Superintendent
Chief Engineer (specialist)
Foreman
Foreman
Workers
Workers
Workers
Workers

LINE AND STAFF ORGANIZATION

1. Specialists are added to relieve the president of some of his burdens.
2. Certain responsibilities are shared by specialists, but they report to the president who retains overall responsibility for operation of the business.
3. Staff specialists only study situations and make recommendations to their superiors. The superiors then proceed to make any decisions.
4. The superiors coordinate the recommendations of all specialists.

With the different types of ownerships to choose from and the various forms of organizational structures available it is easy to understand why manufacturing is a diverse undertaking. There are probably as many forms or combinations of ownership and organization as there are companies in existence. There are also certain basic steps necessary to be successful in manufacturing and a number of specific factors which must be observed carefully.

Manufacturing depends on a number of factors for it's overall success. These factors include money, machines, materials, men, methods, markets and management. SEE DIAGRAM.



MANUFACTURING - FACTORS FOR SUCCESS

Money: A prerequisite to a manufacturing operation. Necessary to provide the plant and equipment, to purchase raw materials, and to meet payrolls until such a time that there is income from the sale of products.

Machines: Includes all production facilities such as buildings, tools, equipment, as well as machines in the strict sense. These are the tools of production.

Materials: Those things that become a part of the finished product offered for sale or that are used in the manufacture of that product.

Men: Those people in the manufacturing concern who use the machines and materials provided to make the product.

Methods: Integrators of machines, materials, and men.

Markets: The means by which a company secures income, not only to pay for the cost of the factors described so far, but also to provide a profit.

Management: The function of planning, organizing, directing, and controlling.

Amrine and others, Manufacturing Organization and Management, p. 3 - 5.

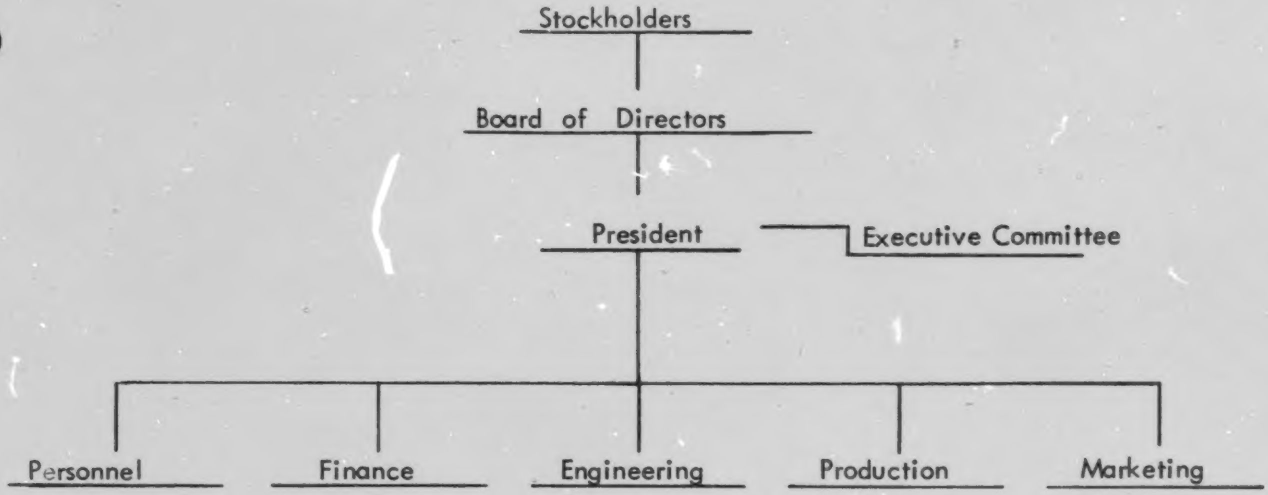
Management includes the functions of planning, organizing, directing and controlling. All the policies and actions of a business involved in manufacturing are governed closely by the management because no human group activity is ever really successful unless it is organized. Therefore, management is the organizing body of industry. Without this management successful manufacturing would become impossible. Coinciding with the factors of successful manufacturing are the six main steps in manufacturing, which are: 1) Identifying what the consumers want, 2) Designing and engineering the product, 3) Production planning, 4) Preparing tools and machines, 5) Accumulating men, materials and money, and 6) Organizing a quality control.

Functions of Management:

Planning : Setting specific goals for the company of various departments and also constructing an outline of the steps to be followed to reah these goals.
Organizing: The process of dividing the overall job into its various parts so they can be assigned to individuals or departments to carry out.
Directing: The issuance of orders and instructions to carry out the company plans.
Controlling: Comparing the performance with the plans as a check to confirm that plans are being carried out.

Management has often been defined as "the accomplishment of goals through others." Management involves the accomplishment of goals or objectives through the use of the management functions. As an activity it is concerned with the work of other people and the direction and coordination of their effort. A person's role as a manager is based on the fact that he coordinates and directs the activities of his subordinates rather than his accomplishment of specific duties. Management applies to all levels of an organization from the lowest-level supervisor to a high-level executive. Authority and the type of problems faced vary greatly for different level managers, but they all are involved with achieving goals through the supervision of subordinates' activities.

A corporation has a distinct method of organizing the efforts of its workers to accomplish the best quality work in the least amount of time. Within a corporation there are a number of separate departments, each with specific responsibilities for completing a job. The five main departments are: Personnel, Finance, Engineering (Research and Development), Production and Marketing. The following chart will give a basic chain of command organization of a company. See diagram on next page.


Stockholders
Board of Directors
President
Executive Committee
Personnel
Finance
Engineering
Production
Marketing

The stockholders are the actual owners of the company. They elect the members of the board of directors whose responsibility it is to run the company and protect the stockholders' investment money. This election would normally be held at an annual stockholders meeting, but in a school situation the stockholders may surrender their vote by proxy and agree to letting the entire class become the Board of Directors.

In most cases there is also an Executive Committee formed which consists of the president and the heads of foremen of each of the five departments. These positions are filled by means of a hiring process that utilizes job applications and interviews. One of the Board of Directors first and most important jobs is to fill the department head positions with the best qualified people. As most of the decision making takes place in the Executive Committee meetings the corporation can begin to function once the Executive Committee positions have been filled.

Department Functions of a Corporate Organization:

Personnel -

1. Secure workers by application and interviews.
2. Keep records.
3. Compile safety and training programs.

Finance and Control -

1. Purchase raw materials.
2. Budget money.
3. Handle stock money.
4. Finance report.
5. Inventory.
6. Check materials.
7. Handle sales money.
8. Liquidation.

Marketing -

1. Advertising.
2. Market survey.
3. Inventory finished goods.
4. Supervise sales activities.
5. Make final market report.

Production -

1. Develop tool control.
2. Cleanup system.
3. Assess plant limitations.
4. Requisition manpower, machines, and materials.

Engineering (Research and Development) -

1. Supervise design teams.
2. Brainstorming.
3. Develop jigs and fixtures.
4. Develop prototype.
5. See that entire operation runs smoothly.

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Sanders, Dr. L. . Directed Field Study Resource Unit. Oswego, New York: Department of Industrial Arts and Technology, State University College. 1967-68.

UNIT D - Industrial Functions

This instructional unit entitled Industrial Functions will attempt to present a somewhat detailed overview of the functions, or jobs, done by each of the major departments that constitute a typical manufacturing company.

In reviewing the particular functions of each department, one should keep in mind that individual departmental functions in actuality, are somewhat overlapping in nature, and when put into practice, this overlapping is inevitable and necessary. These departmental functions are all carried out concurrently, and it can be safely said that they are interdependent upon each other.

Section I - Personnel

The personnel function, in the majority of manufacturing situations, can be sub-divided into six areas of major importance. They are as follows:

1. The staffing and personnel maintenance of company.
2. The maintenance of good management-employee relations.
3. The initiation of safety policies.
4. The handling of employee evaluations.
5. The coordination and conduction of employee services and functions.
6. Public relations.

These six areas can be of key importance in making any manufacturing venture a success.

Staffing the company

In order to efficiently keep a company staffed, the "staffing" function can be further broken down. To fill job vacancies both a pre-bid, and a post and bid system are employed. A pre-bid system is when a job description is posted prior to the actual job vacancy's occurrance. Present employees are then allowed to make application for this position. Applications are reviewed, interviews held, and a present employee is assigned to the position, when it occurs. Until this time he keeps his present job, and a pre-bid would be put out for his job. In this way a company can provide for employee advancement, and can take advantage of existing talent and manpower.

The post and bid system, on the other hand, is probably the method with which most people are familiar. A vacancy occurs, a job description is posted (perhaps in the newspaper),and perspective employees apply. Applications are reviewed, interviews are held and the position is filled.

Once the company has established "John Doe" as an employee, the personnel department maintains an "employee file" on him. Into this file goes such material as positions held, pay information, rating sheets and any other information considered pertinent about this employee.

If the personnel department maintains an organizational chart (see figure 1) the new employees name would be added to this in the appropriate slot and the old name, if any, removed.

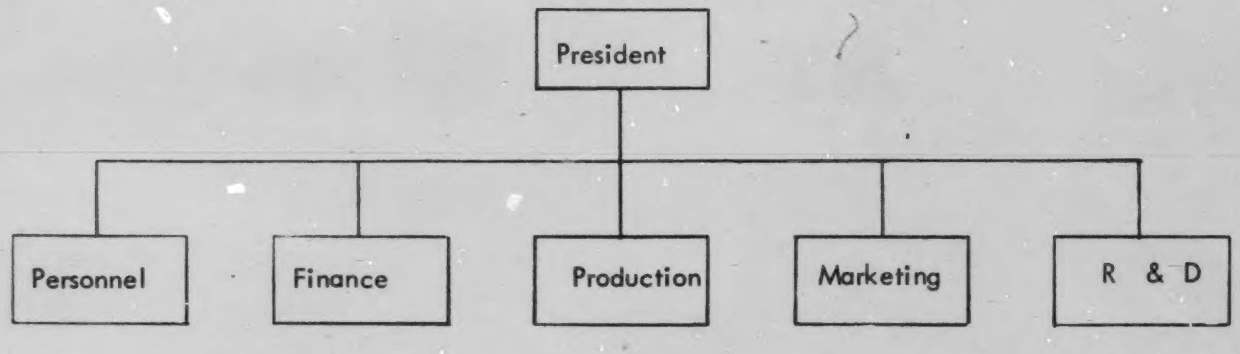


Figure 1

The final sub-function of staffing the company is the maintenance of labor-pool records. This record is kept for two main reasons: 1) should a heavy work load occur, a shifting around of employees from one department to another may be necessary, or 2) on the other hand, if a light work load occurs and employees must be laid off, the personnel department will have records as to who this will be.

Maintenance of good management-employee relations

A second major function of the personnel department is the maintenance of good management-employee relations. Here, the conditions under which each employee works becomes a concern of the personnel department. It is through this division the management and employees decide on such things as paid holidays, paid vacations, sick days, lunch breaks, and coffee breaks. If a union is involved this function might rest upon the union. It is up to the personnel department, however, to establish some kind of grievance procedure, that employees could use to make their gripes heard. Most grievance procedures roughly resemble the one shown in figure 2.

Worker with gripe
↓
Foreman → Satisfaction
↓
Union or shop steward (or Supervisor)
↓
Committee
↓
Final word

Committee composed of personnel representatives, Supervisor, etc.

Figure 2

It is important that each employee realize he will be treated fairly if he has a gripe.

In order to maintain good relations a suggestion box may be in order. This could be a place where an employee can voice his suggestion about any phase of the company, and a system by which employees earn a bonus, by submitting helpful money-saving suggestions is an excellent motivator.

A fourth phase of good relation maintenance is employee training. This ties in with the previously discussed pre-bid job system. Employees are trained for the jobs they pre-bid on, and this is another provision for employee advancement.

Safety policies

A prime responsibility of the personnel function is the setting up and initiation of company safety policies. This may be done by consulting different areas about safety hazards that are present. The personnel department makes sure that each employee is informed about safety regulations and their importance, and no safety rules are infringed upon.

It is also the responsibility of the personnel department to procure safety materials such as safety glasses, hard hats or lab coats.

Employee evaluations

It is once again the responsibility of the personnel department to conduct periodic employee ratings. There are several reasons for doing this. "Dead wood" is eliminated, good workers are rewarded, and promotions made because of these evaluations.

Supervisory ratings are a common industrial method of rating employees - this is a method by which the employees supervisor rates him. If done honestly, this method can be quite effective.

A second type of evaluation is the peer evaluation. An employees' peers will actually evaluate him. Often a man's peers see things his supervisor does not.

Some items that are sometimes included in both type ratings are: quality of work, volume of work, cooperation with others, initiative, and job knowledge. Men can be rated either against a fixed scale, or against one another.

Employee services and functions

The next aspect of the personnel department that will be discussed will be the coordination and conduction of employee services and functions. Items covered in this section may overlap items in the management-employee relations section, but are, needless to say, equally important.

Employee services include such things as payment of college tuition, hospitalization and medical payments, profit sharing plans, etc.

Employee functions include such things as company parties, company picnics, recreational activities, etc. These things all become a part of the personnel function, and one can easily see how they inter-relate with each other.

Public relations

The final aspect of personnel to be presented is public relations work. Any public relations such as company tours, press releases, or flyers sent out about the company are the responsibility of the personnel department.

Section II - Research and Development

Research and development applies to the processes, operations, and techniques of science and technology to create products, processes, and services which may benefit an enterprise.

Research and development may be broken into three main sub-functions. They are: Research, Development, and Product Engineering. Let us, one by one, look deeper into each area.

Research

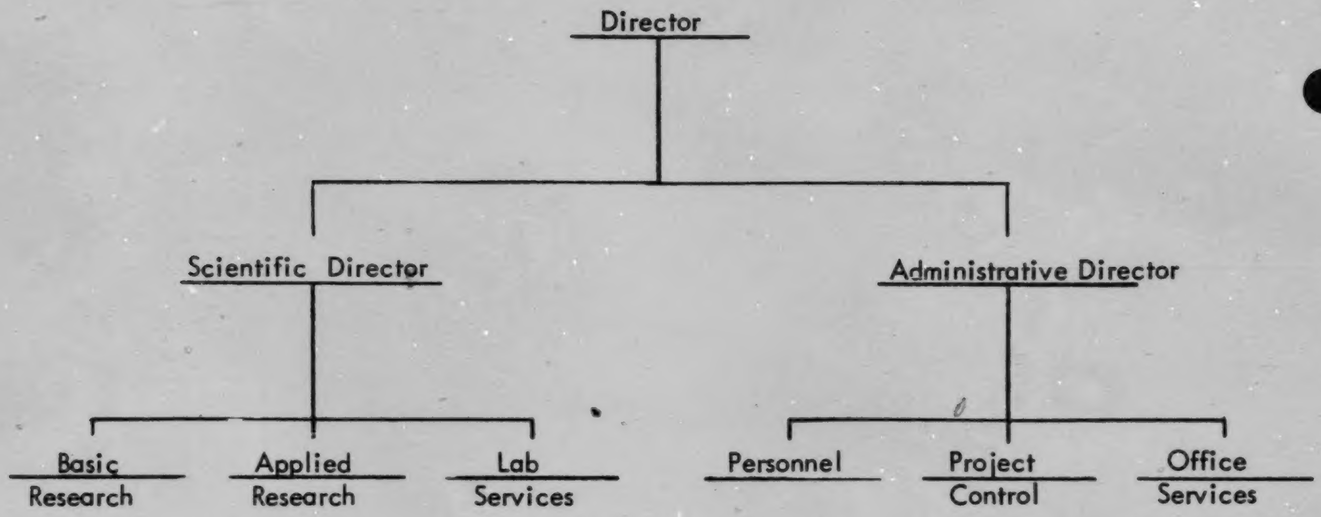
Any company conducts research for one or more of the following reasons:

1. To insure the corporation will operate in areas of growing business activity.
2. Assure maximum use of corporation's resources.
3. Adequately utilize available markets.
4. Diversify corporations activities.
5. Insure increasing profits.
6. Contribute to the companies ability to accept its social and humanitarian responsibilities.

Research can be broadly classified into six categories, the first being fundamental research, or research not referring to a specific end use. Applied research is research aimed at solving a specific problem. Product research is research aimed at improving a specific product. Application advisory research is aiding the customers in application problems. Production Process Research is the improving of specific production processes, and finally, Production equipment research, which is the providing of improved production equipment.

A research department of a typical manufacturing enterprise often performs the following functions: They may search for new chemical or physical relationships. They may improve upon existing products. The research department may find new uses for old products, or may develop new products. Research also tries to reduce present product costs, develop tests and specifications for operations and materials, analyze competitors products, and find uses for by-products. It is obvious that from one company to another, although the actual materials may vary the research process and objectives remain the same.

Below is a typical organizational chart for a research department in a large manufacturing company:


Director
Scientific Director
Administrative Director
Basic Research
Applied Research
Lab Services
Personnel
Project Control
Office Services

Researchers may get their ideas from one or more of the following places:

1. plant personnel
2. professional associates
3. friends
4. company salesmen
5. manufacturing engineering sales representatives
6. advertising agency personnel
7. vendors
8. government personnel
9. customers (market surveys)
10. published lists of available new products
11. professional trade journals
12. professional marketing firms
13. new product announcements
14. professional research and development companies
15. city, county, and state industrial development commissions
16. public utility companies

Development

Development concerns itself with finding a new product or process or improving an old one that will meet a particular need. Development might also be described as designing and engineering new products and new processes.

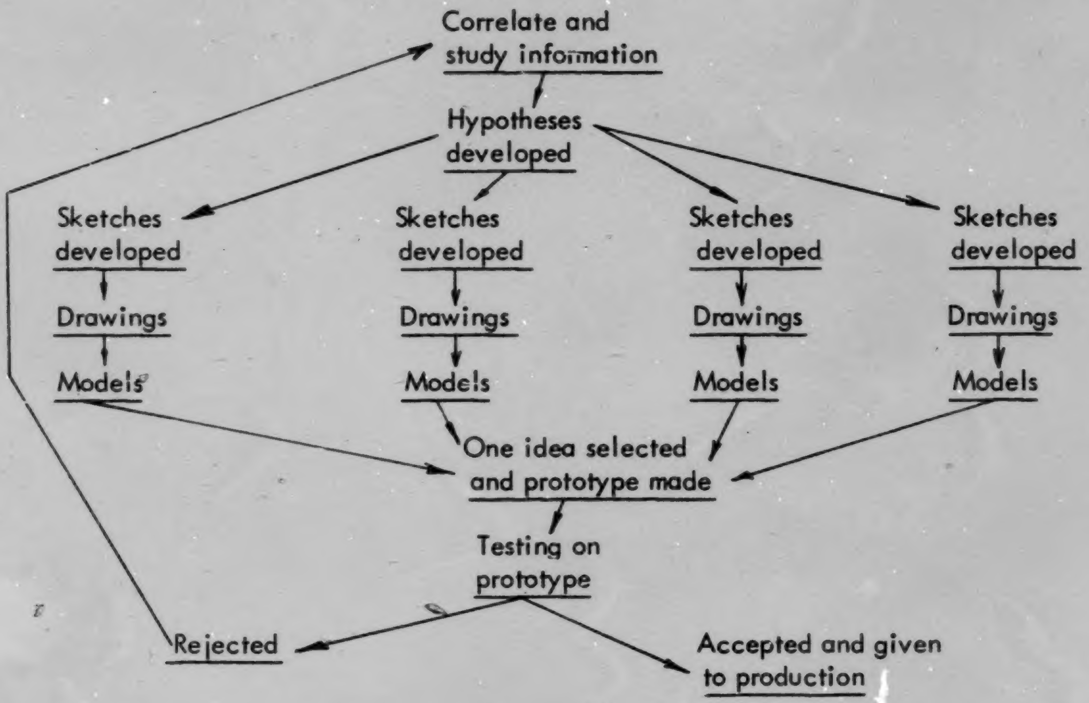
In development the first step is to correlate as much information as you can and study it. All of this material is related to your new product or processes you are trying to develop.

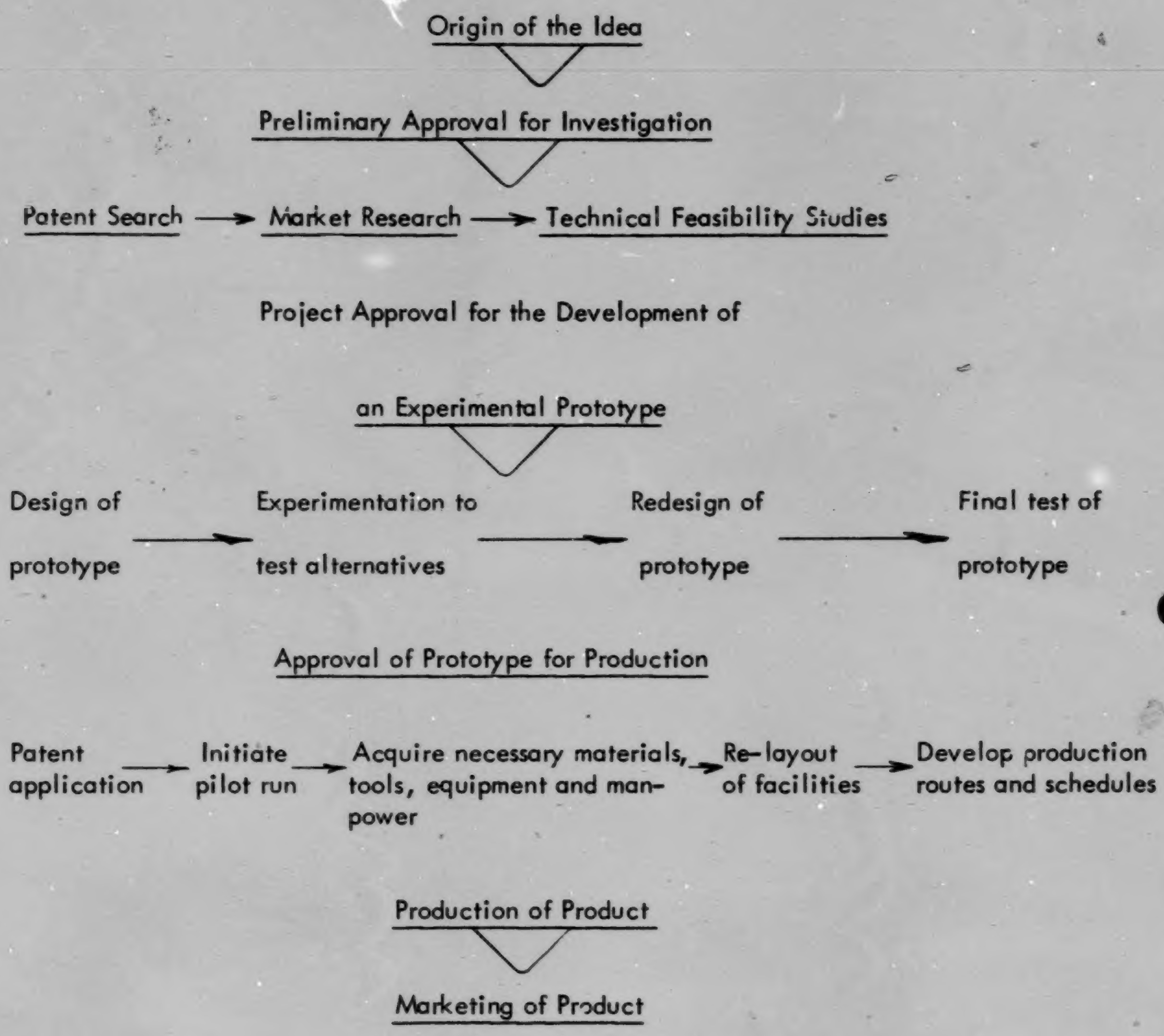
Your next objective is to "develop hypotheses about the features the new process or product should have to meet the particular need."

After formulating the hypotheses a set of sketches are developed to rough out the objects design. From these sketches, drawings and models of the new product or process are produced.

When the drawings have been developed and the final design has been selected a prototype of the product or process is made. A prototype is used to test the production methods, engineering, and design of a product. It is tested to see if it does meet the particular needs it was designed for.

If the prototype does fulfill the objectives the research and developments job is done. If the product does not fulfill the needs outlines, then the knowledge gained from this prototype is stored and the process is started over.


Correlate and study information
Hypotheses developed
Sketches developed
Sketches developed
Sketches developed
Sketches developed
Drawings
Drawings
Drawings
Drawings
Models
Models
Models
Models
One idea selected and prototype made
Testing on prototype
Rejected
Accepted and given to production


Origin of the Idea
Preliminary Approval for Investigation
Patent Search
Market Research
Technical Feasibility Studies
Project Approval for the Development of an Experimental Prototype
Design of prototype
Experimentation to test alternatives
Redesign of prototype
Final test of prototype
Approval of Prototype for Production
Patent application
Initiate pilot run
Acquire necessary materials, tools, equipment and manpower
Re-layout of facilities
Develop production routes and schedules
Production of Product
Marketing of Product

Product Development Procedures

A. New Product Development and Product Re-development
  1. Goals of product development
    a. Consumer acceptance
    b. Maintenance of balanced line of products
    c. Anticipated output and market production
    d. Economical manufacture

  2. Frequency of new product introduction
    a. 7.4% at least every year
    b. 14.2% every 1-3 years
    c. 36.1% every 3-5 years
    d. 23.9% every 5-10 years
    e. 18.4% every 10 years

  3. Identification of product ideas
    a. Unrecorded resources
    b. Recorded resources
    c. Miscellaneous resources

  4. Assessing the merit of new product ideas
    a. Factors considered
      (1) Consumer
      (2) Trade
      (3) Company
    b. Data required
      (1) Sales and Marketing
      (2) Engineering
      (3) Financial

  5. Developing from idea to production
    a. Idea
    b. Preliminary approval
    c. Project approval
    d. Research specifications — RESEARCH
    e. Experimental investigations — DEVELOPMENT
    f. Test runs and samples — PRODUCT ENGINEERING
    g. Final report
    h. Approval for production
    i. Release for production
    j. Product and manufacturing engineering
    k. Production

Product Engineering

Product engineering concerns itself with four main activities. Designing parts or product for function, making working drawings, building production prototypes, and technical writing and illustrating.

Working drawings should include dimensions, allowances, tolerances, and limits.

In the construction of the prototype testing must occur to determine errors, parts failure, and extremities.

Technical writing and illustrating might include instructions, manuals, records, guarantees and warranties, parts lists and operation sheets.

The following is a brief summary of what a product engineering function of the research and development department does:

Product Engineering

A. To design the product for function
   1) Build models for testing
   2) Provide parts prints
      a) Physical dimensions
      b) Materials
      c) Special processes required such as painting, plating, heat treatment, and so on
   3) Provide tool design and construction aids
      a) Master layouts
      b) Templates
      c) Master models
   4) Provide specifications or standards manuals
      a) Material specifications - chemical analysis and physical properties
      b) Specifications for special processes - chemical and physical properties for plating, painting, heat treatment, and so on
      c) Procedures for testing and inspection
      d) Procedures and specifications for joining processes such as welding, brazing, soldering, riveting, and so on
      e) Specifications for threads, gears, splines, keys, etc.

B. To design the product for customer satisfaction
   1) Sales appeal
      a) Appearance - color, and styling
      b) Improvements - changes and additions over the old model
      c) Designs to meet the needs of the customer
   2) Durability and life expectancy of product - parts are designed to satisfy customer by giving the durability expected in relation to cost

C. To design the product for cost
   1) Cost of product must be low enough to compete with similar parts
   2) Cost must be high enough to provide a profit desired by owners of company
   3) Cost must be in correct relationship with durability and life expectancy

D. To design the product for ease of maintenance and assembly
  1) Accessibility for ease of part repair and replacement
  2) Design for ease in assembly and dissassembly
  3) Provide drawings for maintenance and method of assembly

-from Process Engineering for Manufacturing, by Eary and Johnston, Englewood Cliffs, N.J.: Prentice-Hall Inc., 1962. Pages 5-7.

Section III - Finance and Control

The functional area of finance and control is concerned with securing adequate operating funds at minimum cost; maintaining records and preparing reports to measure the results of company operations; and providing accounting services structured for use by managers in planning and controlling the business.

The finance and control department must:
  Forecast the money needs of the company.
  Develop ways of obtaining the needed capital.
  Protect and control the receiving and payment of funds.
  Maintain the requests for all departments and make budget recommendations.
  Explain accurate records of operational and financial receipts and payments.
  Record all transactions in the daily ledger.
  Develop "break - even" analysis and cash receipts and disbursements statements.
  Keep the President and the board of directors informed of important transactions.

Sub-functions of finance and control department:

Finance	Control	Purchasing
Financial planning	General accounting	Buying
Tax management	Cost accounting	Purchase expediting
Financial relations	Planning and budget	Purchase files
Custody of funds	Internal audit	Purchase research
Credit & collection	Procedures	Salvage sales
Insurance		

Corporate financing - the availability and scheduling of capital is essential to providing the materials, facilities and personnel for production.

Budgeting - the budget function serves as a guide for and control over financial operation of the total plant complex.

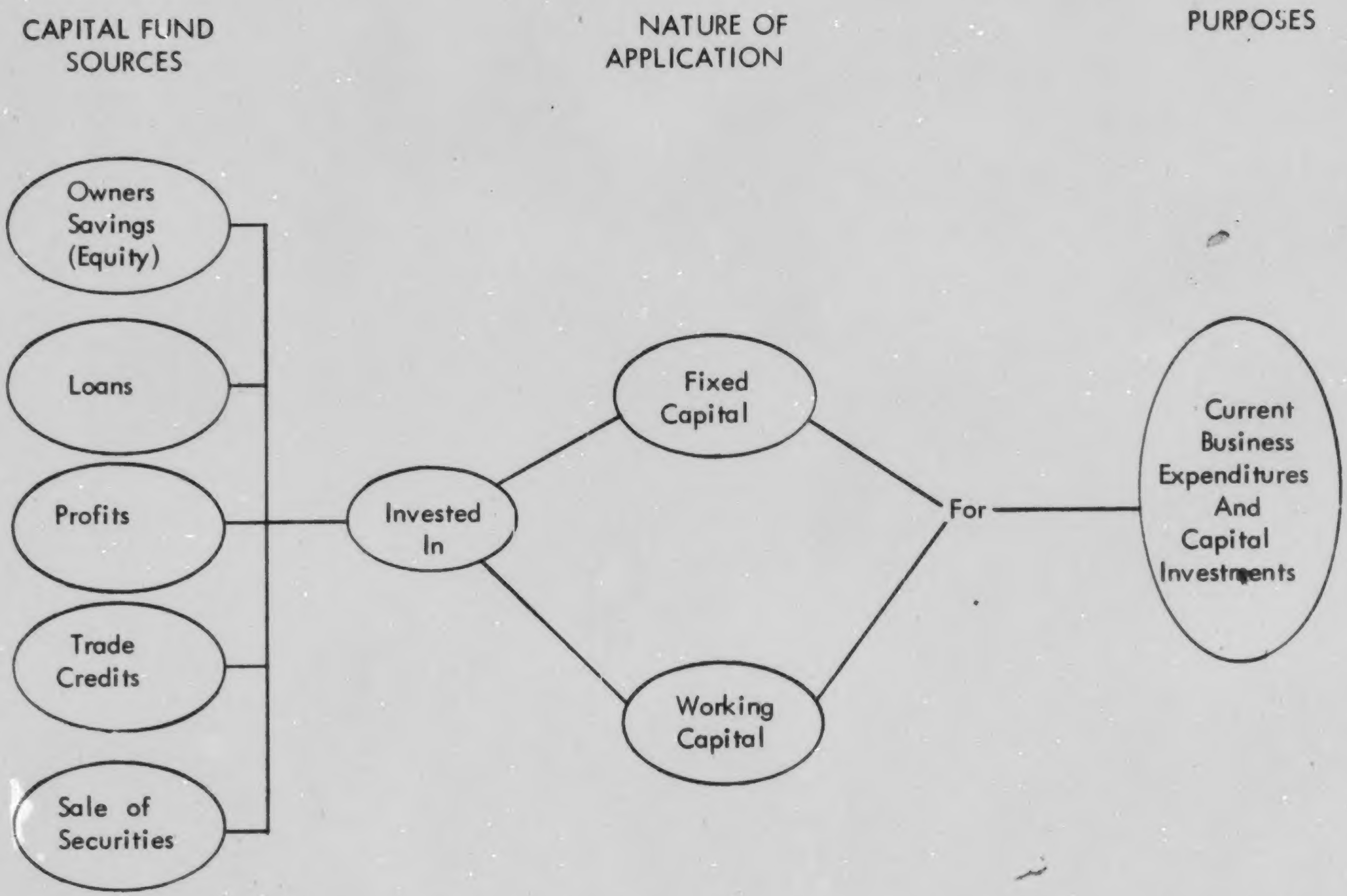
Financial management of capital:
  Kinds of capital -
    Equity capital
      Money put up by owners (i.e., land, buildings, machinery)
    Borrowed capital

- Contains a commitment to repay at future date
- Short term capital
  - Loans made for one year or less; usually for 30 days
- Intermediate term capital
  - Loans made for rarely over five years
- Long term capital
  - Loans made for usually ten, twenty, or fifty years
- Fixed capital
  - Assest used over and over again for extended period of time
- Working capital
  - Money used for payment of wages, advertising, etc.

Sources of capital -

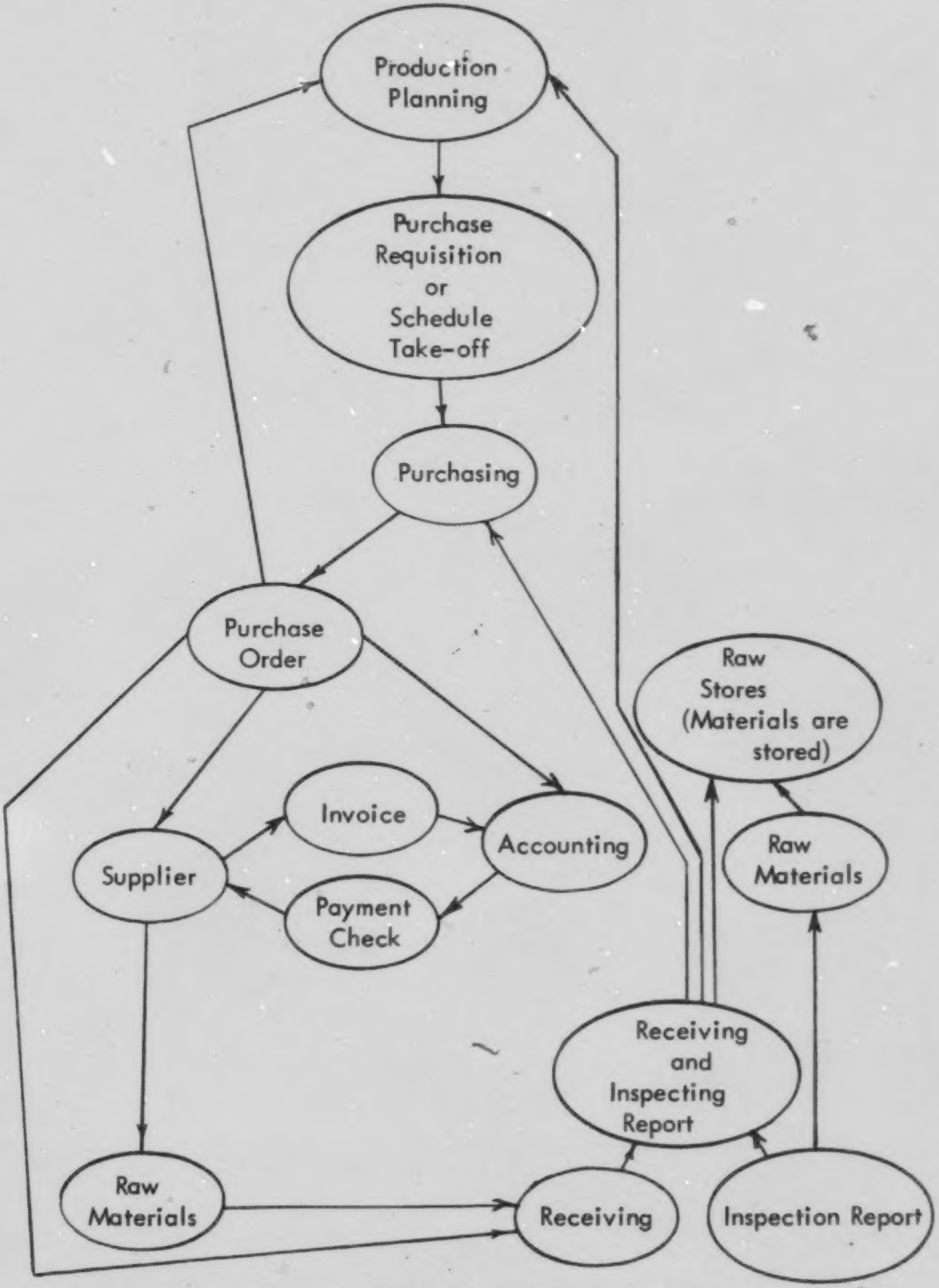
- Savings
  - Basically all capital comes from savings
- Loans
  - These come from personnel friends, relatives, and leading institutions
- Sale of securities
  - Preferred stock
  - Common stock
  - Bonds
- Profit flowback
  - Continual investment of profits back into company

THE SOURCES OF CAPITAL FINANCING


CAPITAL FUND SOURCES
NATURE OF APPLICATION
PURPOSES
Owners Savings (Equity)
Loans
Profits
Trade Credits
Sale of Securities
Invested In
Fixed Capital
Working Capital
For
Current Business Expenditures And Capital Investments

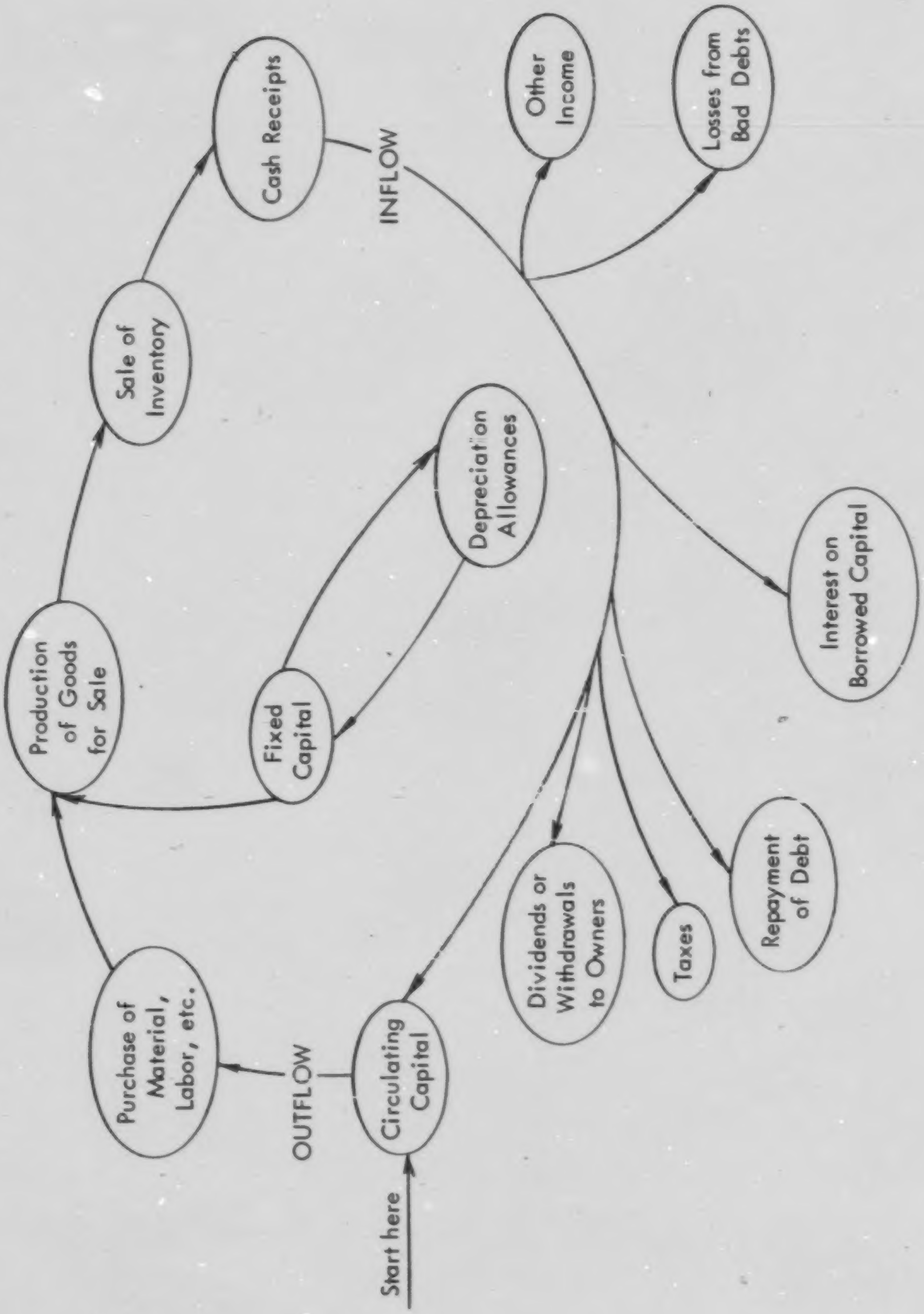
Wheeler, Business: An Introductory Analysis, p. 388.

GENERAL PROCUREMENT PROCEDURE


Production Planning
Purchase Requisition or Schedule Take-off
Purchasing
Purchase Order
Invoice
Accounting
Supplier
Payment Check
Raw Stores (Materials are stored)
Raw Materials
Receiving and Inspecting Report
Raw Materials
Receiving
Inspection Report

Macniece, Production, Forecasting Planning And Control,. p. 183

CASH FLOW


Start here
Circulating Capital
OUTFLOW
Purchase of Material, Labor, etc.
Production of Goods for Sale
Fixed Capital
Depreciation Allowances
Sale of Inventory
Cash Receipts
INFLOW
Other Income
Losses from Bad Debts
Interest on Borrowed Capital
Repayment of Debt
Taxes
Dividends or Withdrawals to Owners

Wheeler, Business: An Introductory Analysis, p. 376

PROFIT: HOW A BUSINESS SURVIVES

(taken from pg. 11, "How A Business Works," Junior Achievement, Inc.)

Every business must make a PROFIT.

HOW COSTS ARE FIGURED

THIS IS WHAT GOES INTO FIGURING THE SELLING PRICE

cost per unit

1. No. of units %%%
2. Raw materials . . . . ________
   Wages . . . . ________
   TOTAL PER UNIT → ________
3. Facilities & machinery . . . . ________
   Shop supply . . . . ________
   Depreciation . . . . ________
   Salaries . . . . ________
   Packaging & promotion . . . . ________
   Administrative . . . . ________
   Miscellaneous . . . . ________
   TOTAL PER UNIT → ________
4. Unforeseen contigencies - scrap and rejects - sales costs, taxes - and PROFITS
   PER UNIT → ________

PRICE Per Unit (Total) ☐

HOW ARE PRICES DETERMINED ?

While the costs are shaped by the company's efficiency, the selling price is shaped by competition and market. The customer is the REAL BOSS: What the customer is willing to pay for a service or product is the final determining factor. In a free economy, where competition is encouraged and a freedom of choice for the customer exists, no "artificial" price can long survive. Keep in mind - consumers do not always buy by price alone, QUALITY also plays a big role. (p.10)

Department

DEPARTMENTAL BUDGET

		1st Period		2nd Period		3rd Period	
	Item	Cost Income	Sub Total	Cost Income	Sub Total	Cost Income	Sub Total
Direct Materials							
Labor							
Overhead							
Totals							

Note: Send carbon copy to Finance & Control and retain original for departmental file.

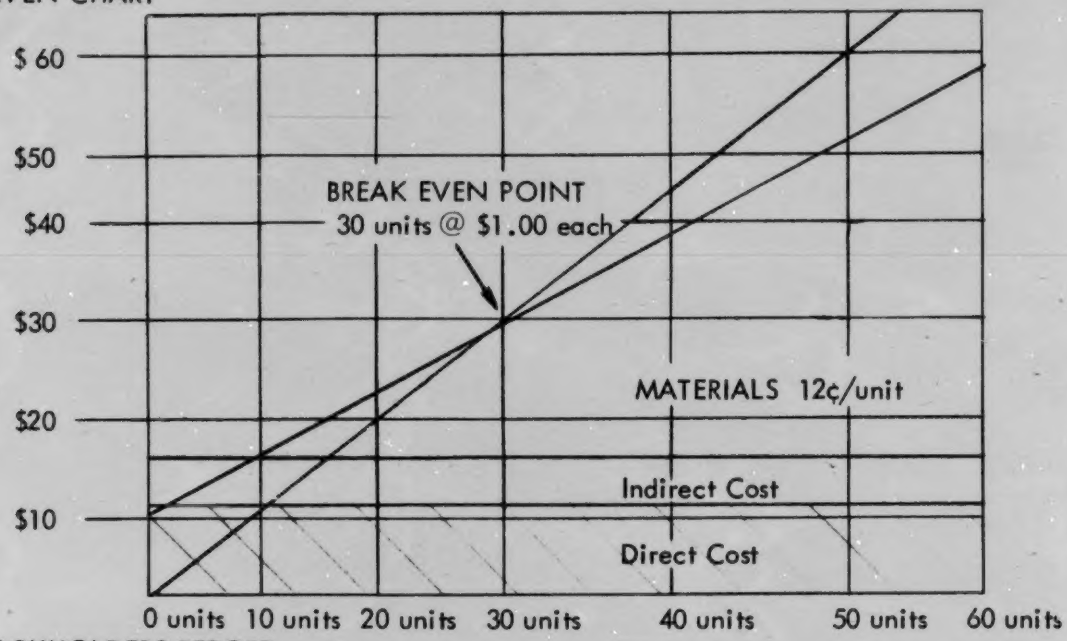
(Company Name)

CASH BUDGET

Line Item No.		Ending Dates of Quarterly Periods			
	Receipts				
1	Sales	0			
	Disbursements				
2	R & D Expenditures				
3	Direct Materials	0			
4	Direct Labor	0			
5	Manufacturing Overhead				
6	Marketing Expenditures				
7	General Administrative Expenses				
8	Total Disbursements				
9	Cash Provided By Operations	( )			
10	Beginning Cash Balance	0			
	Financial Receipts				
11	Stock				
12	Other (loans, credit purchases)				
	Financial Disbursements				
13	Payments to Shareholders	0			
14	Payments to Others				
15	Ending Cash Balance				

Treasurer

BREAK EVEN CHART



THE STOCKHOLDERS REPORT

Your departments final job will be to prepare a profit and loss statement as part of the liquidation and dissolving of the corporation.

Profit and Loss Statement of the
UNIVERSAL COMPANY

Period of Sept. 1, 1971 to Jan 31, 1972

		% of Sales
Income from Sales:		
Sales (number of products x price)	$ 100.00	100
Cost of Goods Sold (materials)	60.00	60
Gross Profit	40.00	40
Expenses:		
Labor (wages and salaries)	15.00	15
Overhead (rent, repairs)	2.50	2.5
Supplies	5.00	5
Total expenses (from gross profit)	22.50	22.5
Net profit before taxes	$ 17.50	17.5
Provision for income taxes 22% net profit	3.85	3.9
Net operating profit	13.65	13.6

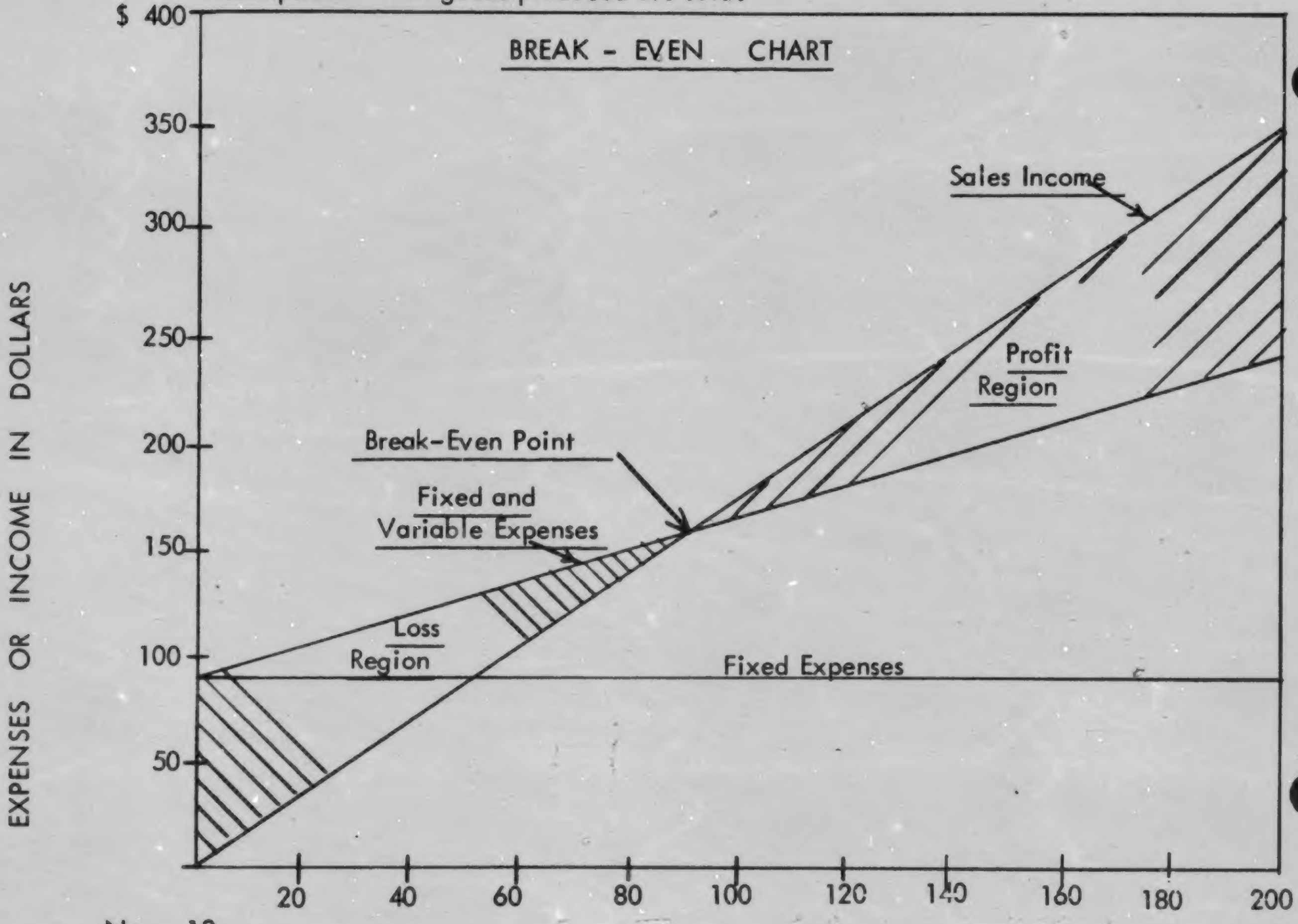
Note: income tax is paid to school or selected charity as necessary cost of doing business.

Taken from Mfg. 190 resources - FINANCIAL RECORDS FOR STUDENT COMPANIES.

Budgetary planning can be more effective by using a break even chart analysis. This analysis will help student companies in estimating and determining production levels and selling prices.

In the chart below, a company producing a product with the given cost factors (i.e., fixed costs totaling $90 and variable costs at $.75 per unit) would have to produce 90 units at a price of $1.75 per unit ($350 divided by 200) in order to break even. Naturally, they would want to produce above that level to make a profit. Periodic break-even analysis would indicate the need for cost reduction programs or other measures related to budget objectives (or, perhaps, a new budget).

*Assumption: All goods produced are sold.

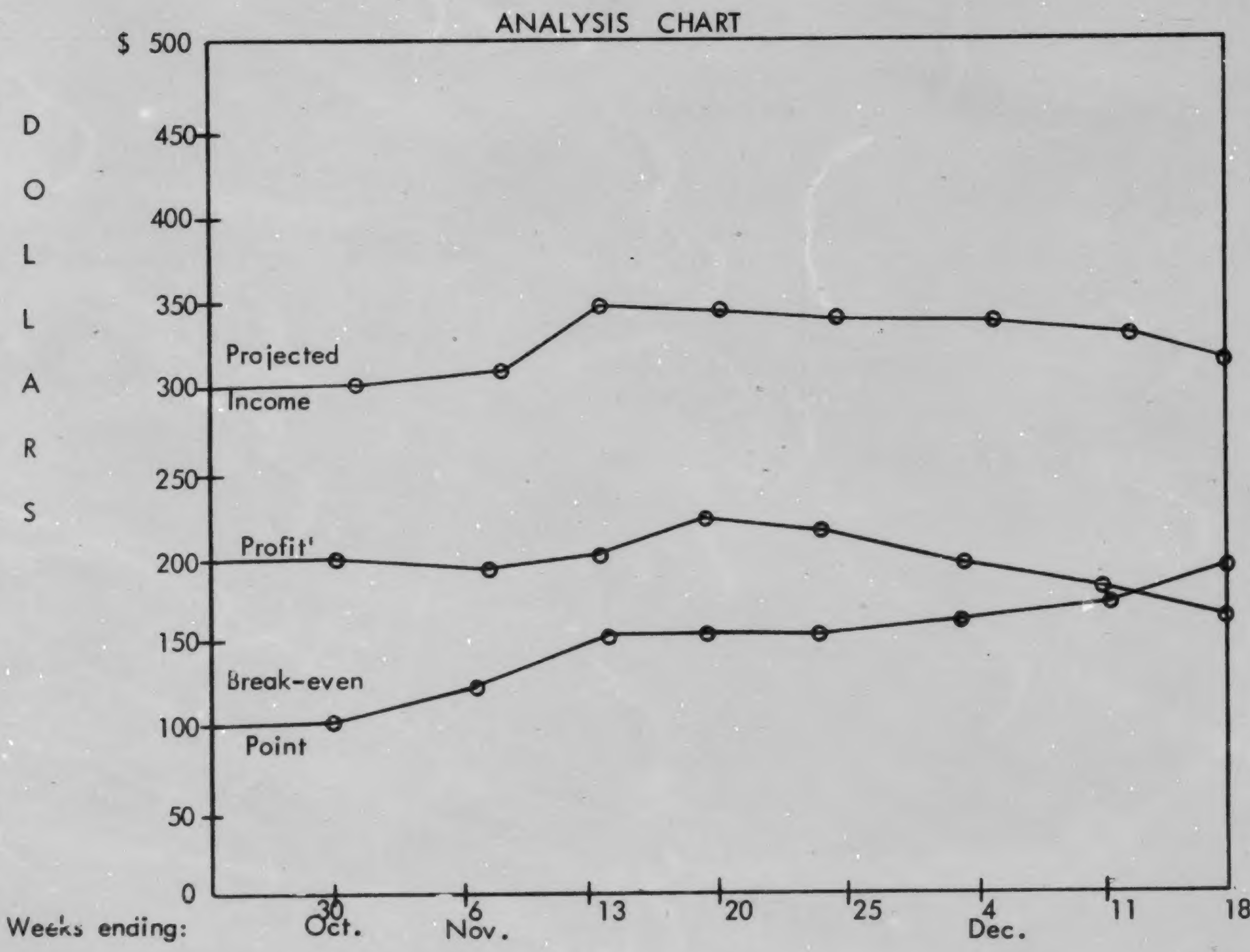


Nov. 13

The ANALYSIS CHART is a means of noting the progress, week by week, of the anticipated income to be received, profit expected to be made, and the point at which the company will break even.

This information comes directly from each week's break-even chart. If the Finance department posts the Analysis Chart where it is plainly visible, each student on the board of directors will gain a little more insight into the financial aspects of the industrial enterprise.

The information recorded on the following chart for the 13th of November comes from the break-even chart on the preceding page.



Student companies should not feel unduly frustrated with the difficulties they face in operating a simulated corporation. Most annual stockholders reports from large corporations start out with a Presidnet's Letter which has terminology such as that which follows:

> A substantial part of the decrease in our earnings for 1966 compared with 1965 was experienced in the start-up cost of new plants, new ventures, and the digestion of some acquisition. Slow delivery of equipment added to our start-up cost. We also sustained losses in operation and reorganization of our Japanese subsidiaries.

The preceding quote came from Rexall Drug Chemical Company Annual Report 1966. In the Copperweld Steel Company the 1966 Annual Report we have the following statement:

> For Copperweld Steel Company, the year 1966 was a year of contrast, in which benefits realized from completed capital improvement programs at the company's fabricating divisions were more than offset by start up and break in costs associated with the installation of new facilities and the Aristoloy Division.

The point in bringing these statements to your attention is that mature corporations sometimes have difficulties in realizing profits from their newly acquired plant and companies which have start up and break in costs. We are certainly at a greater disadvantage than they are, given our lack of experience and history. Practically all of these reports emphasize research and marketing activities. All of the predict, in a guarded statement, a rosy future.

Source: FINANCIAL RECORDS FOR STUDENT COMPANIES, Mfg. 190
resource.

Section IV - Production

Production may be defined as follows: Developing the most economical methods for manufacturing authorized products; Coordinating the required manpower; Securing and coordinating materials, tools, facilities and utilities; Producing products and consigning them to the marketing activity or customer.

In order to perform as a department in a manufacturing organization the production department is often broken down into sub-functions which are: Plant Engineering, Industrial Engineering, Production Planning and Control, Manufacturing, and Quality Control.

Plant Engineering may be defined as the specifying or approving, installing, maintaining and occasionally constructing the buildings, utility services and facilities required to produce new products. Factors that come into play in the plant engineering function are things like plant layout, size, equipment, growth of the present plant, type of plant layout, process layout and devices used in layout. It is the plant engineering function that determines process and operation flows.

Industrial Engineering is planning the utilization of men, facilities, tools, jigs and fixtures to attain the desired quantity and quality of output at minimum cost. Industrial engineering is assigned to look for the best production methods and processes. When considering the manufacture of a product, the industrial engineering department looks at several important factors, such as:

Availability - Can the product be made on the equipment owned by the company?

Capacity - Will the method of production produce as many products as the company needs?

Quality - Will the method of production produce acceptable quality?

Personnel - Will new operators be hired and trained if a new process is used?

Materials handling - Where will the storage of materials be located, and is there enough space?

Overall economy - Will the methods and processes chosen produce enough parts at good quality to satisfy the demand at the lowest possible cost?

To answer these questions jobs in the areas of methods studies, plant layout, work measurement, materials handling, and tools, jigs and fixtures are assigned.

Production Planning and Control is responsible for getting the right material, in the right amount to the right place at the right time. It is also responsible for keeping the right production rate, the best use of manpower, space and equipment. Production planning and control is responsible for seeing that materials being used are kept used in the best way with as little waste as possible.

To accomplish this task of getting the right materials to the right people the department uses certain controls, These controls help to make production a smooth flowing operation. (See process flow chart)

Types of production controls:

Order control - The correct number of parts must be gotten for the correct number of orders.

Inventory control - There must be the correct stock of standard parts and other parts the company does not make themselves. This is so that they can fill an order without a delay due to the lack of materials.

Production control is also involved in the flow of products throughout the plant. Some sub-divisions of this area are:

Traffic - This is to control the flow of all materials within the plant.

Receiving - This is in charge of taking care of incoming materials. This includes raw materials and sub-assembled parts.

Shipping - Shipping is in charge of sending out the finished product whether it be a finished product or a sub-assembly.

Distribution - Distribution has the power to distribute the materials through the shop, and also to stores and retailers.

Dispatching - This is the letting-go of materials from the stockroom through the use of orders and request forms.

Expediting - Expediting makes the orders flow quicker for faster production.

Procurement - This is to order materials and machinery needed for production.

Scheduling - Scheduling is checking flow charts, time studies.

Tooling - This is in charge of setting up the jigs and fixtures.

Reporting - Reporting is done through board meetings and department meetings.

Store-keeping - This keeps track of spare parts, tools (drills), and other materials.

Stores control - This is in charge of distribution and requisitioning.

Quality control is the function responsible for establishing acceptable limits of variation in the attributes of a product, and reporting the status of maintaining the product in respect to those limits. Without quality control, mass production would not work because the "trick" for mass production is the interchangeability of parts.

Control methods should be set up to allow for the best possible types of control.

Input control is when the raw materials are inspected to see that they meet the required specifications. To achieve some set standards you must first start with good raw materials.

In line inspection the product or product parts are inspected for defects before final assembly. If many defects show up in certain part work, the work must be stopped to find the cause for the defects.

A final check is the last inspection the product will get before it is shipped. At this point the product will either be passed or rejected.

Gage control, another term for tolerance, is an important aspect of quality control. When parts are made the workman is given a certain amount of play or accuracy which all parts are to be made. This degree of inaccuracy is taken into account by the engineers and must be enforced by the quality control inspectors.

Inspecting and testing is the area of quality control that creates the types of tests the product must undergo and also how many of these products will be tested.

Consumer complaints are handled by quality control because it is either their job to know how the product is operating even after the product is out of the plant. With consumer complaints quality control should know how to correct the faults of the product.

Manufacturing is the area of production responsible for making products for sale by changing the shape, composition, or combination of materials, parts or sub-assemblies. Manufacturing could be a parts-manufacture, a sub-assembly, a final assembly or a service and repair. One might say manufacturing is the actual putting together or building of the product.

Station work sheets are used at each particular job or work station to give information concerning machines used, special machine set up, set up time, materials needed, tolerances, production rate, and operational procedure. (See Station Work Sheet)

STATION WORK SHEET

Station No.____________________ Operator____________________

Operation____________________________ Product____________________

Sketch of Completed Part

Set-up

Equipment

Operational Procedure

Set-up Time	Materials	Tolerances	Production Rate

PPOCESS CHART

BASE

Square stock
↓
Center hole
Cut circle
↓
Sand to size
↓
Hole for rod
↓
Hole for gluedowels
↓
Paint black
↓
Varnish

LEGS

Square stock
↓
Cut semi-circle
↓
Cut angle
↓
Light sand
↓
Holes for dowel
↓
Assembly
Varnish

ROD

Cut to length
↓
Bend bar
↓
Cut to length
↓
Drill holes for string
↓
Grind burrs
↓
Paint

DOWELS

Cut to length
↓
Sand square
↓
Round end
↓
Sand
↓
Varnish

Section V - Marketing

Basically, the marketing function in a manufacturing operation can be broken into four sub-functions which are 1) Market Research, 2) Advertising, 3) Sales, and 4) Distribution.

Market Research is the diligent and thorough search to find significant facts and relationships pertaining to any subject or problem in the field of marketing.

Market research is used to analyze markets through telephone surveys, ads in newspapers and magazines, mail, personal interviews, free samples and prototype displays.

Market research also estimates sales potential of a product. To do this, certain questions must be asked. Price determinations, specific likes or dislikes, quantity a single customer will buy, quantity of people that will buy. Some basic techniques are unrestricted random sample, judgement sample, probability sample.

Market research is the key area in determining customer preference. Overall impression of product, likable and unlikable qualities, why or why you would not buy the product are typical questions asked by the market research function.

Market research reports it findings to the research and development department and they work in its findings to their modifications.

The Advertising function of the marketing department is responsible for the non-personal presentation and promotion of ideas, products, or services paid for by a sponsor.

Advertising organization can be sub-divided into campaign planning, copy preparation, media selection, and production.

Advertising can appeal to hunger, love, vanity, fear or any emotions that motivate people.

The functions of advertising are to recruit new customers, retain old customers and prevent the loss of customers. Advertising can be national, regional, local, retail, trade, industrial, professional, and institutional.

The Sales function is responsible for whether or not the product to be sold will be sold to a wholesaler, manufacturers agent, selling agent, retailer. By selling consignments or directly to the consumer, the manufacturing organization must have a salesman to sell people on the product - Why brand "Y" is better than brand "X".

Pre-sales is a method of selling a product that can be quite successful with student companies. This is a method by which an order is taken and a downpayment paid prior to manufacture of the actual product. When the product is complete the remainder of the price is paid to the company by the customer and who, in turn, gets his product.

There are three parts to a successful sales pitch: 1) Approach - talk to the customer, use his name, don't use sympathy as a motive; 2) Demonstration - now bring out the product, hand it to the customer, and let him examine it. Answer his questions and accept all criticisms; 3) Close by asking for his order in a way that he can't say no.

Sales includes:

Sales promotion - which includes sampling, contests, special events, displays and brands and trademarks.

Sales planning - is the study of factors determining price, which are supply, demand, substitute products, competition, attitude of buyers and laws. Sales planning also covers the area of packag Packaging protects quality, keeps product clean, provides honest weight and makes for easy brand identification. Displayability, slackability, and protection are all concerns of sales planning.

Distribution may be defined as the process of getting the product into the hands of the ultimate consumer.

Channel of distribution may be defined as the exchange of ownership of a product until it finally reaches the hands of the ultimate consumer.

Manufactured products can be distributed directly from the manufacturer to the consumer or from the manufacturer through a series of middlemen to the consumer.

Brokers - find buyers and sellers for the product, and negotiate the price terms and terms of the sale. Steel is sold in this way.

Manufacturers agents - sell the products of a number of non-competing manufactures in his area. Trailers may be sold this way.

Selling agents - are like large sales departments that are not under the control of the company. Here there is minimum control over selling price and policies. A small manufacturer may get his product sold over a large area.

Selling consignment - with this type arrangement the manufacturing company retains ownership until the retailer sells the product. Manufacturers have control over the selling price and policies of his product. Eliminates price wars which may be destructive to the product's image.

To determine the best means of product distribution one should consider the following things:

1. Cost
2. Selling price and policy importance
3. Area that the product is to be sold in

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4. Gerbracht, Carl and Frank Robinson. Understanding America's Industries. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1962.

5. Hauenstein, Lux and Ray. The World of Manufacturing. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1971.

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UNIT - E Production Tooling

What is production tooling? It is basically planning the special tools, machines and equipment necessary to manufacture a new product. In a classroom situation the machines you use are limited by what is available in the shop. The special tools you will need, however, will be developed by your class. These special tools will include jigs, fixtures, templates, casting patterns, dies, etc. I will confine production tooling to the area of jigs and fixtures as they are the most important and useful part of production tooling.

Jigs and Fixtures

A jig is a special device which, through built in features, determines the locating dimensions which are produced by machining or fastening operations. Jigs automatically accomplish layout or location. In short, Jigs guide an operation or process.

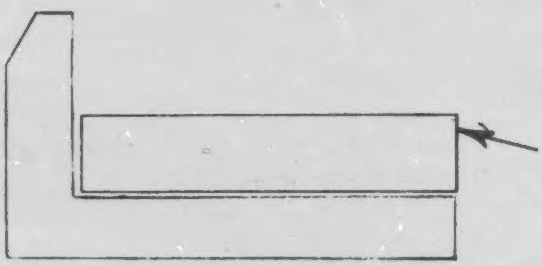
A fixture is a specially designed, quick acting acting holding device, which presents a part to the tool or holds work during machining or assembly operations. (general purpose devices such as a clamp or vise do not fall into this catagory since they are not designed for a particular part or shape).

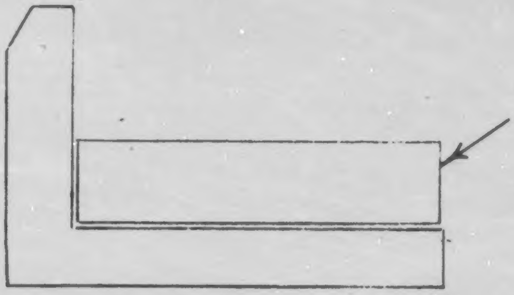
Obviously many production tools meet the objectives of both jigs and fixtures, since they are special devices which both hold the work and determine critical dimensions. However, fixtures never accomplish the functions of jigs. Jigs are connected with operations (drilling, welding, assembling, etc.), while fixtures are related primarily with specific machine tools such as milling fixtures, lathe fixtures, etc.

Basic Factors In Jigs And Fixture Design

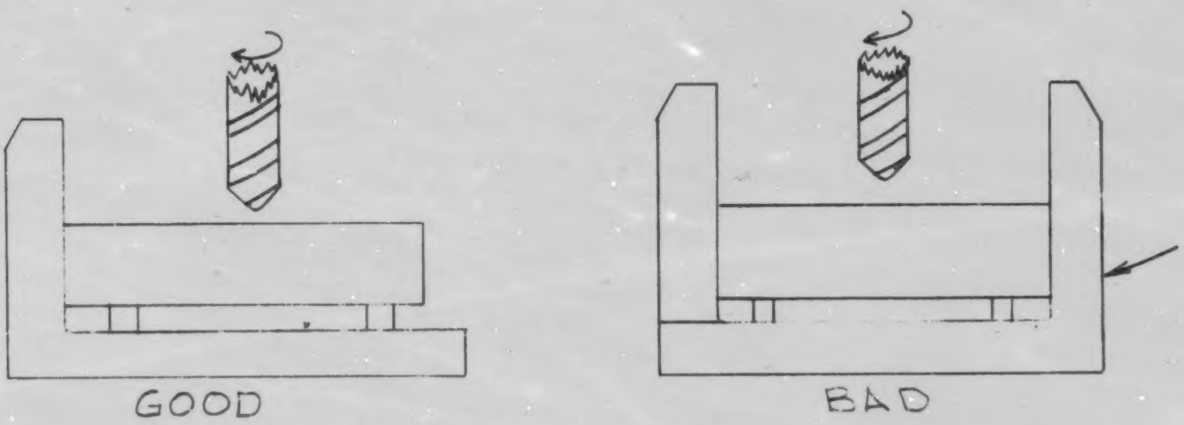
Clamping

A Clamping stresses should be kept low.
B Clamping forces should be directed against the strongest points of work support.
C As many operations as possible should be done with each clamping of the work.



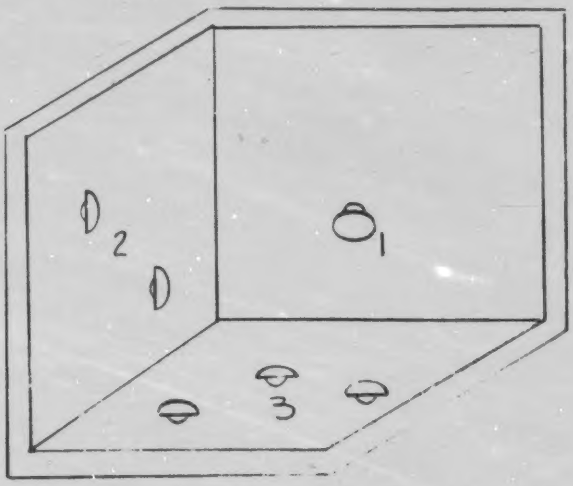


Supporting the work (against the forces imposed by the cutting tool)



Location of the work piece for dimensional control. (This requires adherance to the 3 - 2 - 1 principle.

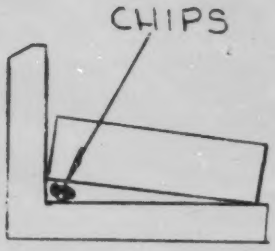
3 - At least 3 locating points are required to locate an object on the first plane.
2 - At least 2 points are required on the second plane.
1 - At least 1 point is required on the third plane.



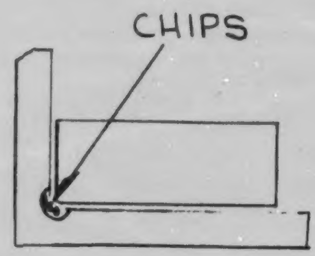
Guiding the tool when required. (This is to eliminate measurement)

It can be accomplished through the use of stops, bushings, guides, pins, buttons, etc.

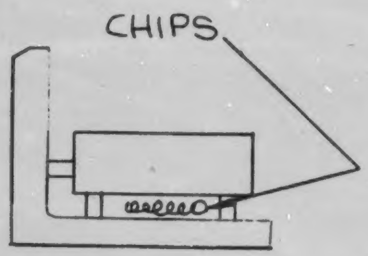
Provision for chips - when jigs of fixtures are used in connection with chip making operations, adequate provision must be made for chips. This is necessary for two reasons. 1) To prevent the chips from packing around the tool causing over heating or possible breakage. 2) To prevent them from interfering with proper seating of the work.



BAD



GOOD



GOOD

To Provide For Rapid Easy Operation

There are several ways in shich jigs and fixtures can be made easier and more rapid to use. 1) The method in which the work is clamped. (Some type of clamping mechanisms are more easily operated than others.) ex. Knurled clamping screws, cam type latches, etc. 2) Easy operation. (Do not make the procedure for using them too complicated.).

Standards To Look For In Production Tooling

A Jigs must be sturdy enough to with stand breakage by unskilled operators.
B Hand work such as counting, filling containers, trimming, etc. should be eliminated through production jigs and fixtures.
C Build safety into jigs and fixtures.
D Spend the most time on jigs designed to eliminate bottlenecks.
E A sketch of the production tools and fixtures and an operation sheet for each process allows the students or operators to learn the principles of an operation on their own.
F Materials for the jigs and fixtures should be easy to machine and shape and only meet the requirements of the job. (Do not overtool) Wood and sheet metal are very good materials for making jigs and fixtures for limited production projects.

When To Use Jigs And Fixtures

A When time and money saved by using the device, reflected in an increase in amount and accuracy of production, more than offset the initial cost of jig and fixture production.

B To eliminate the need for highly skilled employees on the production line.

Total skill required for the job = Skill built into the tool + Skill required from the worker

C To eliminate the need for set up and layout location.
D To develop increased accuracy during production.
E To insure repeatability and standardization.

Common Types Of Jigs And Fixtures

A Clamp jig of fixture - dove tail template
B Simple jig or fixture - drill through guide
C Channel jig or fixture - work slid into place
D Box jig or fixture - work enclosed in holding device

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Bennett, Chas. A. General Industry. Peoria, Ill.: Lindbeck/Lanthrop Publishing Co., Inc. 1969. P. 122.

Hauenstein, Lux, and Ray. The World of Manufacturing. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1971. Pp. 144-153.

Gerbracht and Robinson. Understanding America's Industries. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1971. P. 214.

UNIT F - EVALUATION

These selected means of evaluation are the result of a co-operative efforts of pilot program student teachers and are not at all meant to limit your scope of evaluation strategies, but rather to help direct you toward meaningful evaluation procedures of your students during their simulation of a manufacturing enterprise.

Alternative means of evaluation:

1. Manufacturing Pre and Posttest
2. Student Progress Report
3. Student Self-Evaluation
4. Teacher's Progress Sheet
5. Teacher Evaluation

Manufacturing Pre and Posttest
School____________________
Name____________________
Period____________________

Select the best answer for each question. There is only one answer for each question. Put the correct answer on the answer sheet and do not put any marks on the test paper.

1. The "Father" of mass production was
   a. Ben Franklin
   b. Eli Whitney
   c. Henry Ford
   d. Thomas Jefferson

2. The department responsible for training people is
   a. Marketing
   b. Engineering
   c. Personnel
   d. Finance

3. A special tool that holds and locates a part is called a
   a. jig
   b. fixture
   c. vise
   d. V-block

4. The __________ department is responsible for advertising.
   a. finance
   b. marketing
   c. engineering
   d. production

5. The department that hires people through job applications and interviews is
   a. marketing
   b. engineering
   c. finance
   d. personnel

6. The department that handles the sales and distribution of a company's product is
   a. finance
   b. marketing
   c. personnel
   d. production

7. To increase the speed of laying out large numbers of particular parts industry would use a
   - a. rule
   - b. dividers
   - c. template
   - d. jig

8. The following are principles of mass production:
   - a. delivery of work to the workmen
   - b. planned and continuous progression of product through shop
   - c. a breakdown of a product into its various operations
   - d. all of the above
   - e. none of the above

9. A device that locates the piece being worked on, holds it in place, and guides the tool is a
   - a. fixture
   - b. jig
   - c. clamp
   - d. template

10. To control a company a person must
   - a. be president
   - b. be on the board of directors
   - c. be a department head
   - d. hold fifty-one percent or more stock

11. Product planning includes
   - a. the idea
   - b. drawings
   - c. pilot model
   - d. production planning
   - e. all of the above

12. Interchange able parts are
   - a. precision parts
   - b. same size and shape
   - c. accurate
   - d. all of the above
   - e. none of the above

13. The process of putting all the parts of a product together is called
   - a. sub-assembly
   - b. capital
   - c. parts production
   - d. final assembly

14. Henry Ford is noted for
    a. interchangeable parts
    b. cotton gin
    c. moving assembly line
    d. automation

15. Which of the following groups of people represent management:
    a. president
    b. foreman
    c. board of directors
    d. all of the above

16. The department that handles raw materials and parts control is
    a. marketing
    b. personnel
    c. finance
    d. production

17. The money raised by the selling of stocks is called
    a. payroll
    b. capital
    c. profit
    d. revenue

18. If the company is working in the red it is
    a. losing money
    b. making money
    c. breaking even
    d. none of the above

19.. A flow chart shows
    a. rate of flow
    b. floor plan of factory
    c. path of materials through work stations
    d. parking space for factory employees

20. The research and development department
    a. sells stock
    b. make prototypes
    c. advertises
    d. none of the above

21. Quality control is part of which department:
    a. Research and Development
    b. Personnel
    c. Production
    d. Marketing

22. The producer is the one that:
   a. uses the product
   b. makes the product
   c. sells it to the consumer directly
   d. none of the above

23. The consumer:
   a. makes the product
   b. sells the product
   c. distributes the product
   d. uses the product

24. Which is not a function of the personnel department:
   a. interview people
   b. sell stock
   c. train employees
   d. keep employee records

25. The board of directors is made up of
   a. the workers
   b. the stockholders
   c. the vice presidents and president
   d. none of the above

26. Distribution of the finished product is handled by the __________ department.
   a. personnel
   b. marketing
   c. research and development
   d. production

27. A trademark is
   a. a product name
   b. a department
   c. a company symbol
   d. a type of stock

28. Most of the blue collar workers in a company belong to a
   a. bowling team
   b. credit club
   c. union
   d. none of the above

29. Safety is part of the __________ department.
   a. personnel
   b. research and development
   c. marketing
   d. production

30. Inventory is
    a. the number of employees
    b. the amount of money in the bank
    c. the amount of stock, parts or products on hand
    d. none of the above

Answer Sheet Form

1. B
2. C
3. B
4. B
5. D
6. B
7. C
8. D
9. B
10. D
11. E
12.. D
13. D
14. C
15. D
16. D
17. B
18. A
19. C
20. B
21. C
22. B
23. D
24. B
25. D
26. B
27. C
28. C
29. A
30. C

30. Inventory is
    a. the number of employees
    b. the amount of money in the bank
    c. the amount of stock, parts or products on hand
    d. none of the above

Answer Sheet Form

1. B
2. C
3. B
4. B
5. D
6. B
7. C
8. D
9. B
10. D
11. E
12.. D
13. D
14. C
15. D
16. D
17. B
18. A
19. C
20. B
21. C
22. B
23. D
24. B
25. D
26. B
27. C
28. C
29. A
30. C

SELF - EVALUATION

Name____________________ Period__________ Department____________

Were you the department head? Yes or No

1. During the past six weeks I worked _________ of the time in class.
    a. all
    b. some
    c. very little
    d. none

2. I _________ tried to complete the job given me to the best of my ability, regardless of its nature.
    a. always
    b. sometimes
    c. seldom
    d. never

3. I _________ tried to work with the best interests of our company in mind.
    a. always
    b. sometimes
    c. seldom
    d. never

4. I _________ tried to understand, work with or help others.
    a. always
    b. most of the times
    c. sometimes
    d. never

5. I _________ tried to follow the safety rules when operating the machinery in the shop.
    a. always
    b. most of the time
    c. sometimes
    d. never

6. Did you work along with the rest of your department?
    a. always
    b. most of the time
    c. sometimes
    d. never

7. When using machinery and tools I __________ tried to use them for their correct purpose.
   - a. always
   - b. most of the time
   - c. sometimes
   - d. never

8. List the major activities in which you were involved.

   1.
   2.
   3.
   4.
   5.
   6.
   7.
   8.
   9.
   10.

9. If given an opportunity to be in another manufacturing class would you join?
   Yes or No

10. What do you think you have earned as a grade for this marking period?
    Grade__________

11. In a paragraph or so justify the mark you have given yourself.

12. Evaluate the others in your department.

	List Names	Department	Grade
1.	____________________	____________________	__________
2.	____________________	____________________	__________
3.	____________________	____________________	__________
4.	____________________	____________________	__________
5.	____________________	____________________	__________

TEACHER PROGRESS SHEET

MASTERY OF SUBJECT

A Excellent

B Above Average

C Average

D Below Average

F. Not Acceptable

EFFORT

1. The pupil consistently applies himself to his work and does the best he can and is interested in his work.
2. The pupil is generally conscientious.
3. The pupil is inconsistent in his application to his work or is half-hearted in his efforts.
4. The pupil is indifferent and needs constant urging to do any appreciable work.

CONDUCT

S - Satisfactory
N-Needs Inprovement
U-Unsatisfactory

	ORGANIZATION & ORIENTATION			PRE-PRODUCTION			PRODUCTION			POST PRODUCTION		
NAME	GRADE	EFF.	COND.	GRADE	EFF.	COND.	GRADE	EFF.	COND.	GRADE	EFF.	COND

UNIT G - RECOMMENDED RESOURCES

The following resources noted with asteric (*) are recommended for the teacher instituting this program for the first time, or with a limited budget.

BOOKS

1. Abramowitz, Irving. Production Management. New York: The Ronald Press Co., 1967.
   TOPIC INCLUDED: Production Control; Inventory Control; Quality Control; etc.

2. Amrine, Ritchey, Hulley. Manufacturing Organization & Management. New Jersey: Prentice Hall, Inc., Second Edition, 1966.
   The purpose of the book is to acquaint the person inexperienced in the field of management with the principles and functions of manufacturing management.

* 3. Apple, James M. Plant Layout and Materials Handling. New York: The Ronald Press Co., Second Edition, 1963.
   TOPIC INCLUDED: Plant Layout Problems; Consideration in Planning Material Flow; Receiving, Storage, and Shipping Activities

* 4. Association of Consulting Management Engineers, Inc. Common Body of Knowledge for Management Consultants. 1957.

5. Biegel, John E. Production Control. New Jersey: Prentice Hall, Inc. 1963.
   A study of the application of statistical techniques to the solution of problems of production and inventory control that are fundamental to all enterprises.

6. Buskirk, Richard H. Principles of Marketing. New York: Holt, Rinehart, and Winston, Inc. Third Edition, 1970.

* 7. Gerbracht & Robinson. Understanding America's Industries. Ill.: McKnight & McKnight Publishing Co., Second Edition, 1971.
   A concise look at America's industries through the eyes of professionals in the field. (e.g., Wood Industries; Metal Industries; Graphic Arts Industries; etc.)

8. Hilton, Peter. Handbook of New Product Development. New Jersey: Prentice Hall, Inc. 1969.
   TOPICS INCLUDED: Scientific Advances; Consumers' Wants Change; Business Needs Have Also Changed; World Competition

9. Kelley, Lawyer & Baumback. How to Organize and Operate A Small Business. New Jersey: Prentice Hall, Inc. Fourth Edition. 1966.
HIGHLIGHTS: Financing and Organizing the Business; Advertising and Sales Promotion; Production Control; Simplified Record Systems; Profit Planning and Cost Control.

10. Lindbeck, Dr. John R. & Lathrop, Dr. Irwin T. General Industry. Peoria, Ill.: Chas. A. Bennett Co., Inc. 1969.
AVAILABLE: Text; Workbook; Laboratory Manual.
A very good reference book for a manufacturing course

* 11. Lux, Donald G. & Ray, Willis E. The World of Manufacturing. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1971
The bible of manufacturing developed by Ohio State University. A complete manufacturing guide which includes: Text, Illustrations, Laboratory Manual, Teacher's Guide.

12. Michelon, L.C. & Slesinger, Reuben. Understanding Basic Economics. New York: The World Publishing Co, 1967.
Economics and its relation to industry.

13. Poe, Jerry B. The American Business Enterprise. Homewood, Ill.: Richard D. Irwin, Inc. 1969.
This book provides an introduction to the field of business administration through the combination of text and case materials designed to illustrate the breadth of decision-making required in the management of today's business enterprises.

14. Smith, Lavon B. & Maddox, Marion. Elements of American Industry. Bloomingon, Ill.: McKnight & McKnight Publishing Co.

15. Scobey, M.M. Teaching Children About Technology. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1968.

16. Fierer & Gronneman. General Shop. Bloomington, Ill.: McKnight & McKnight Publishing Co. 1970.

PAMPHLETS

1. Maher, Edward I. Automation - ABackground Memorandum. National Association of Manufacturers. April, 1960 (illustrated)
"A reading for clergymen and lay people interested in the moral and ethical implications of economic and social questions affecting American industry."

* 2. Kettering, Charles F. & Orth, Allen. American Battle for Abundance. General Motors. Detroit, Michigan. 1947. (illustrated)
A story of mass production.

3. Boarman, Professor Patrick M. Facts and Fancies about Automation. National Association of Manufacturers. (illustrated)
It deals with the radical change of our economic and political system due to feedback control and electronic data processing.

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    2. Product Development - Pg. 223
    3. Statistical Quality Control (Process Control)
    4. Production - Pg. 223
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    2. Production Control I - Pg. 823
    3. Production Control II - Pg. 823
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    6. Production - Pg. 823
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  3. American Business System: The Challenge of Management
  4. Industrial Management: Internal Organization
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* A. Society for Visual Education, Inc. Chicago, Ill. Industry in Twentieth Century America Group I
  1. Production Engineering
  2. Manufacturing
  3. Industrial Engineering
  4. Plant Engineering
  5. Quality Control

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A. American Industrial Arts Assoc.,
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  2. Production Experience

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14. Seal, M.R. "Go Gunning For Mass Production Enrichment", School Shop 28. February, 1969. P. 51-53.
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PART III

GUIDELINES FOR PACKAGE IMPLEMENTATION

D. Bristol
D. Lutz

This section, containing three sub-divisions, is intended to provide the instructor with an idea of how "manufacturing" can be implemented in the school shop situation.

The Manufacturing Concepts and Suggested Student Activities section identifies basic understandings (concepts) common to all manufacturing industries, and is supported with student activities related to each of these concepts. The students will gain a realization and awareness of the company operations through these activities.

The Implementation Analysis section provides a comprehensive overview of the total manufacturing program including student departmental functions. Frequent referral to the concepts-activities and to the student modules will place the program into proper perspective.

The Possible Problems and Solutions section identifies selected operational problems and respective solutions experienced by the student teachers during the implementation phase of their corporate simulation and are offerred to aid the instructor in the actual running of his own manufacturing program.

IMPLEMENTATION ANALYSIS

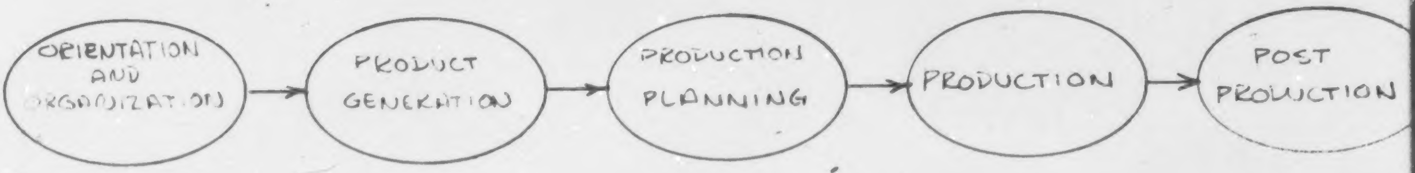
Introduction

The following section deals with the different variations of implementation of the manufacturing program. Included in this section are the main phases and departments with a description of the activities and optional activities that should keep your program rolling smoothly . There are usually several ways or variations of student activities which bring about desired outcomes. The purpose of this "analysis" is to identify for you as many alternative instructional procedures as possible which will bring about changes in student behavior as identified in the Manufacturing Concept Section.

This package may be used for a program of 6, 10, or 20 weeks in length. The length of time spent on it depends entirely upon you as an instructor. This package was developed by student teachers who were involved with a mini-manufacturing program of a 6 weeks duration.

Included in this package is a unit on Mass Production with suggested products and drawings. This unit may be a one or two week program all by itself or it may be only a one day ordeal. Again, we provide the ideas and offer direction, the rest is in the hands of you as an instructor.

In our simulated enterprise as with all real enterprises there are basically five phases of company development, organizing and orientating the company. They are illustrated below.



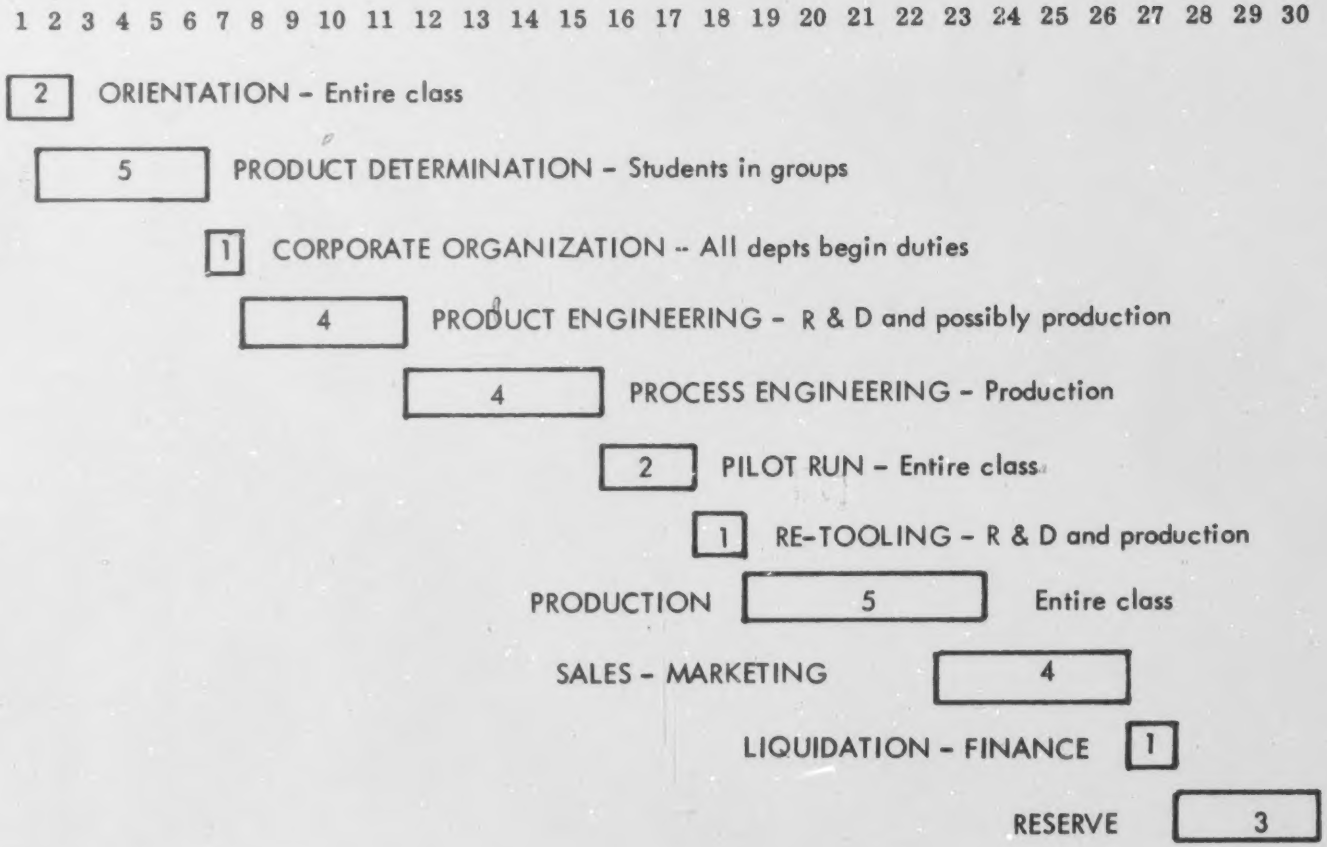
As this unit on alternative methods of implementation is read, keep in mind these five basic phases, as they will help you gain a prospective view of the company's overall development and operation from beginning to end. Also, note that the student modules will be most beneficial towards alternative methods of implementation.

Of the four groups of student teachers involved with the development of this package, most of them started their program with a discussion concerning what is manufacturing and how it is important to our way of life. A film concerning duties of each department and the production of a product is very helpful in the understanding of corporate organization. The film that was used to good effect was "The Factory, How a Product is Made", this film is listed in the resource section of this package. An orientation to basic corporate structure of most manufacturing industries would be another successful way of relating, to the

6 WEEK PROGRAM

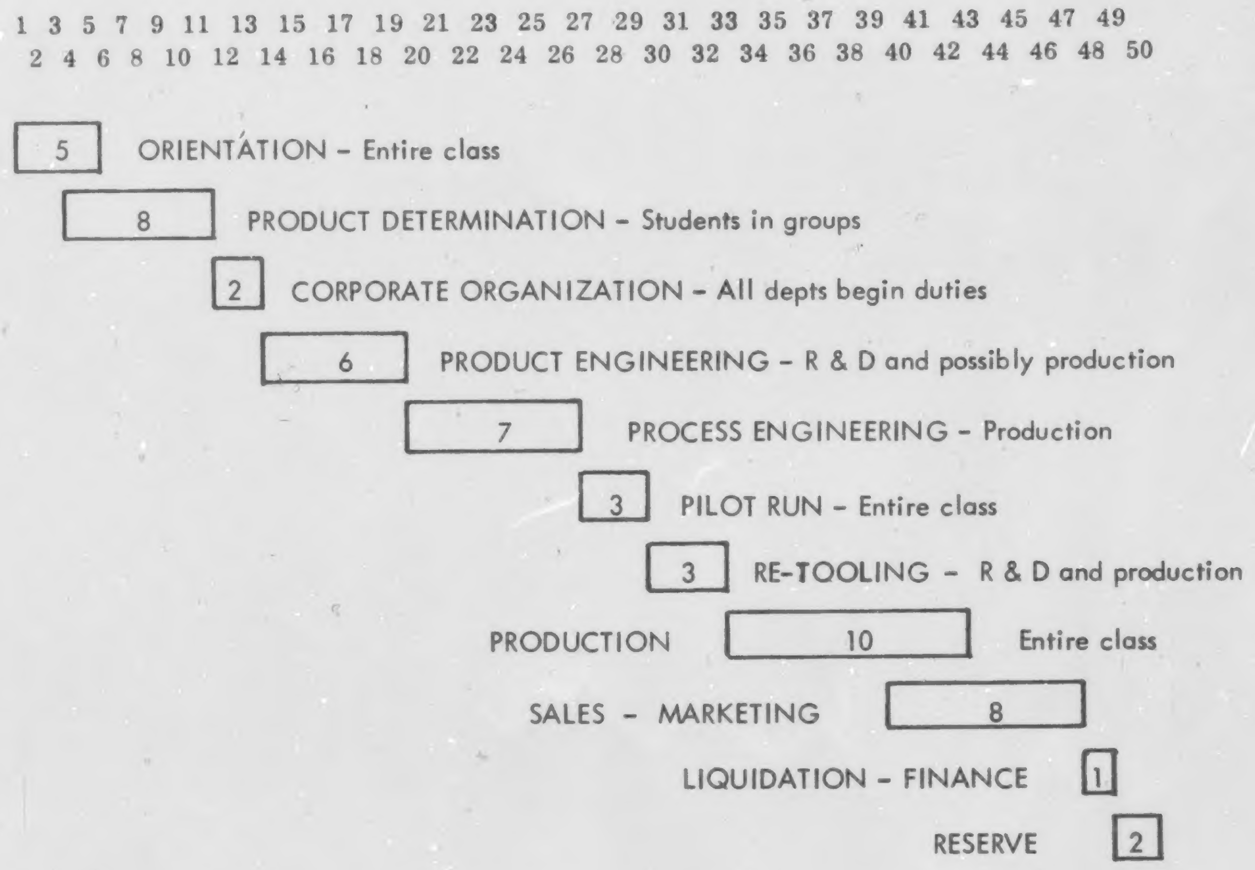
(Sample Schedule)

DAYS OF PROGRAM


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
2 ORIENTATION – Entire class
5 PRODUCT DETERMINATION – Students in groups
1 CORPORATE ORGANIZATION -- All depts begin duties
4 PRODUCT ENGINEERING – R & D and possibly production
4 PROCESS ENGINEERING – Production
2 PILOT RUN – Entire class
1 RE-TOOLING – R & D and production
PRODUCTION 5 Entire class
SALES – MARKETING 4
LIQUIDATION – FINANCE 1
RESERVE 3

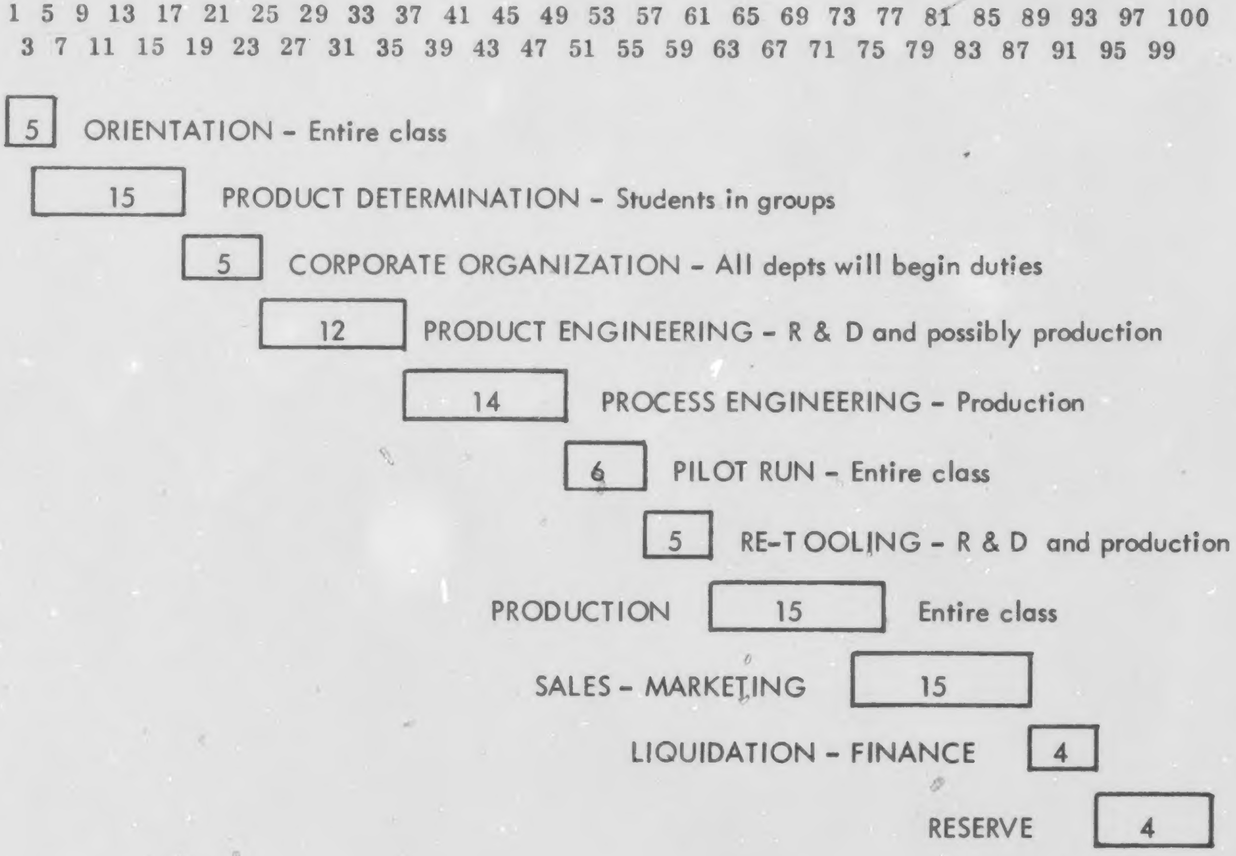
10 WEEK PROGRAM

(Sample Schedule)
DAYS OF PROGRAM



20 WEEK PROGRAM

(Sample Schedule)
DAYS OF PROGRAM



5 ORIENTATION - Entire class
15 PRODUCT DETERMINATION - Students in groups
5 CORPORATE ORGANIZATION - All depts will begin duties
12 PRODUCT ENGINEERING - R & D and possibly production
14 PROCESS ENGINEERING - Production
6 PILOT RUN - Entire class
5 RE-TOOLING - R & D and production
PRODUCTION 15 Entire class
SALES - MARKETING 15
LIQUIDATION - FINANCE 4
RESERVE 4

students, how a company organizes to produce a product.

This time or phase of company development is often a little slack with regards to student activities. Again refering to the student activities identified with the respective sub-concepts there are,in the previous sections,plenty of purposeful activities that can be used during this phase.

During this organization (also orientation for your students) and orientation period the class should be made aware that they as a whole will make up the Board of Directors. At this time a Personnel department head and assistant should be selected either by students volunteering, being nominated by the class, being selected by the instructor, or the instructor may choose to act as the Personnel administrator until a student is interviewed and selected. Ideally these two Personnel men will assume full responsibility of staffing the remaining departments of the company.

Product Generation

The area of product generation is a most important one. Company activity funnels towards the production of a product or products. Therefore, at this phase of development, a good product choice is mandatory to insure its saleability and to promote success to the company endeavor.

There are various methods for a company to use to determine a product. One method used quite frequently is called Brainstorming. In this method every one in the company will think of any kind of product they can with no restrictions whatever. After 15 minutes, which is generally plenty of time, a wealth of ideas will have been drawn from the students. At this time the ideas should be classified into major groups and committees formed to consider the best product within the group and then construct models of their ideas.

Another method would be to have the students construct models of their ideas for a product and then try to "sell" it to the class as a whole. Following the class choice a number of products for further consideration are classified into groups and prototypes are developed.

A third method would involve the instructor suggesting sample products to the class and then committees are formed to develop these ideas further. This would work best if the class fails to come up with any feasible ideas.

A consideration to make note of before the development of models would involve parameters of limitations on the products. (ex. product must not be larger than hand size,cannot cost more than $2, may be made only of wood, etc.) Since models are used in all of the above methods be sure to have plenty of model materials on hand for your students to work with. Whatever method is used will inevitably end up with models of their ideas constructed.

The next step is to sell the ideas to the class as a whole. Market research on each product would indicate to the class which product would be saleable to the market available. After these presentations a final product should have been chosen by the students.

Company Name

Once the product generation has evolved a suitable product, a company name is selected, usually paralleling the product name. For an example, a company decided to produce a 3-D Tic-Tac-Toe and they chose the name 3-D Enterprises as their company name. It is advisable to stay away from Inc. titles due to possible legal questions. A method of choosing the name could relate back to the brainstorming concept. Different names are suggested and then the most appropriate is chosen. Marketing could have a contest giving away a free product for the best company name.

Appointment of Officers

Every industrial enterprise needs officers (department heads) to manage their company. This is also true of the simulated company at junior or senior high school level. One method of filling the jobs would involve appointment by the instructor. This method may be appropriate if the students were not willing to select officers or due to a time limitation. The Board of Directors (class) may also elect the personnel to file the necessary jobs. The best means of accomplishing the job placement is to have the Personnel department make up employment forms and interview students determining those best suited for a particular position.

note: The election of the president should take place at a later date when the company is able to operate on its own.

From this point on the company will function as departments as outlined on the following pages.

Personnel

This department should be the first to be set up. The first duty would be to design an employment form and then have each company member indicate their job preference and abilities on that form. Personnel then selects the proper persons for the offices of the company.

This department should make up an organizational chart and write in the names of the officers on this chart. This will prove to be a good reference when location of departments heads is necessary. There is plenty of interaction between departments, as you are well aware of by now. Personnel willwork closely with the Production department in the development of a training program for the employees.

An important activity of the Personnel department involves the preparation and initiation of a good safety program to maintain the safety factor for the on the job worker. A thorough examination of the machines, jigs and fixtures,etc., should be made to help with the preparation of the program. Any other problems regarding safety should be made known to the Personnel department where corrective measures may be taken.

Personnel must develop a means of evaluating a workers progress. If the worker was not checked at intervals, he would become lax in his work and production would suffer. A method used to good advantage is the merit rating system. This form may ask questions that deal with such things as attitudes towards work, attitudes towards fellow workers, cooperation, punctuality, etc. This also helps as an aid when class evaluation by the teacher is necessary. Usually, the class members are very honest and accurate, if not even critical of their peers .

When visitors are touring the simulated factory, the Personnel members will assume the role of tour guide. They should provide each visitor with safety glasses, provide a good description of activities, and answer questions in a courteous manner. The Personnel department could also establish a policy for paying each worker. In order for this department to establish their policy of payment, they must set up a recording system for attendance, hours worked outside of class, etc. The pay, of course, would be simulated.

In order to better the relations, Personnel may choose to develop a suggestion system in which the employees may offer their comments toward the betterment of the company operation. This may include a suggestion form and a suggestion box as part of the system.

Research and Development

Once the product generation phase has produced a product to be developed further, the Research and Development team takes over. The department head may ask Personnel for 3 or 4 more workers to assist them with the various parts of the product development.

The students involved with this development may brainstorm the various ways that the product could be designed to improve its appearance, functional aspects, etc. Small committees within R&D may be formed to produce sketches of their ideas and then a discussion of these drawings would follow. The next step would be to construct prototypes of the best ideas to actually see what possibilities and/or problems might be associated with the ideas. A decision would be made by the group as to which prototype was best. Marketing would prepare market research forms for the prototypes and the obtained data would provide the decision.

Once the final prototype has been developed R&D will want to perform tests on the product to see if it meets the established requirements . R&D will want to make up working drawings of each product part and a drawing of the finished product will follow. This will aid marketing in preparing advertisements and production with their tooling.

Finance and Control

While Personnel and R&D have been actively involved with company and product development, Finance and Control (F&C) has been busy planning to raise capital for the company. F&C should review stock certificates available and design their own which is applicable to their company's needs.

F&C should prepare departmental budget forms asking each department to plan their needs after which an accurate budget may be produced stating sales expected, direct material costs, overhead expenses, and labor costs.

Once the budget has been approved F&C should estimate the cost of the product in order to determine the selling price. This aspect as well as all activities in this section on ideas for implementation are very well covered in the modules for students.

F&C now has the means to discover how many units must be sold to break even. This is the time for a break-even chart to be constructed. Periodic break-even analysis would indicate the need for cost reduction programs or other measures related to budget objectives (or a new budget).

At the time of liquidation the F&C department will want to develop a profit and loss statement in their stock holders report. F&C will then recall all stocks and pay dividends. (For other selected student activities and more detailed information refer to the student module on this area.)

Production

The production department begins its initial activities during the R&D phase. They will work closely with jig and fixture development and then from working drawings will produce the necessary tooling. Production should draw up assembly plans to prevent any problems which might occur at that time.

This department must plan and prepare a process chart that shows each operation that must occur for each component. This will tie in with the need to develop a workable flow chart which gives direction of product flow from beginning to end. They may wish to move certain machines to speed up production by eliminating wasted movements of materials and laborers.

Quality Control is an integral part of this department. Arrangements must be made to develop methods of inspection for each product part. These may involve the use of visual inspection, sense of touch, gauges, testing of the part, etc. Quality Control may inspect either randomly or a continuous piece inspection. The parts must be inspected to insure standardization.

Production is also concerned with purchasing and maintaining invertories. F&C will develop the necessary purchase forms and production must submit the forms to F&C for approval before they can be okayed. Production must be responsible for maintaining their own inventory.

Pilot Run

Production should initiate a pilot run before actual production takes place to reveal any problems. Before actual production, these problems should be corrected. They may include:

1. Alteration of jigs and fixtures, 2. Addition or elimination of work stations, and 3. Changes in routing procedures.

Upon finalization of the pilot run, mass-production of the product should begin. All members of the company will probably be on the line until production is completed.

Marketing

The first item concerning the marketing personnel, relates to the market research data during product generation and R&D. These forms should include such information as do you like the design of the product, would you purchase one or more, any suggestions, how much would you pay for it, etc. After an analysis of the data, marketing should suggest recommendations to the R&D department for incorporation into the product.

Marketing is vital in the sense that they are responsible for selling all the products produced. They must plan to advertise using such media as school and local newspapers, P,A. system, radio commercials, posters, displays, contests, etc. They must make the market aware that they have something to sell

Once the products are finished, marketing must maintian a running inventory of items that have been sold and those on hand. They should set aside one area for storing the products until they are sold. Marketing may wish to produce pre-sales forms that requier 1/2 price as a down deposit. This would insure the sale of a certain number of products before sales and also provide some capital for debts owed.

Marketing is then responsible for the packaging of the product. Several methods may be employed such as the use of acrdboard., plastic bags, heat sealed plastic, vacuum formed protective coverings, etc. Tags should be designed that will identify the product, state the price and give any other pertinent information. Your students should keep in mind that the packaging should be protective as well as attractive for the package gives a first impression of their company product.

DEPARTMENT: Corporate Organization

CONCEPT: The functional area of management is concerned with the principles of organization as used in industry and accomplishes the goals of industry by coordinating the efforts of others.

Sub - concepts (understandings to convey)	Suggested Student Activities
1. Forms of Organization: Every business must have skills available - technical skills to produce, marketing skills to sell, and management skills to make a profit - and a suitable structure is selected to keep it running. They may select from one of the following: individual proprietorship, partnership, or the corporation.	A. Discuss with the students the various types of ownership. 1. "What is a corporation?" (possible film) 2. Invite a resource speaker to discuss forms of ownership with the class. 3. The teacher could draw from the class experiences and advantages and limitations which accrued to the various types of ownership which would be progressively exposed.
2. Relationship between Ownership and Management: A corporation adopts by-laws as its basic rules of operation: they describe the companies responsibilities, its administrative set-up and the duties of the officers it employs to run its day-by-day business.	A. Students will discuss a set of teacher prepared by-laws, modify them, and accept them. Optional: 1. After introduction by the teacher, students will develop their own by-laws. 2. After introduction by the teacher, students will develop their own company by-laws.
3. Organization in Manufacturing: Direction must be given in any undertaking so that the goals or objectives may be met. A manufacturing company obtains direction from its officers. A selection of company officers must be made, thus the stockholders elect a board of directors who, in turn, select the company management.	A. Students will fill out application forms. B. A selection committee will review applications. C. The personnel director and an assistant will be selected to begin company organization.
4. Stockholders: Stocks represent shares of ownership of a company and, also, the investment is	A. Students will design shares. B. Students will sell their shares. (Refer to implementation analysis)

Sub - concepts (understandings to convey)	Suggested Student Activities
evidenced by certificates, each setting forth the name of the holder and the number of shares held. A stockholder thus becomes a part owner in the company.	C. Students may open a checking account at the local bank. D. Students may use teacher and/or student designed checking account forms to handle their money in the classroom.
5. Line Organization and Line & Staff Organization: The structure of a small business may be such that one individual may direct all personnel and be responsible directly for all operations. However, in a large operation one man cannot obtain all the talents necessary and thus other individuals must be given the responsibility of certain special activities. They are directly responsible to the president of the company.	A. Personnel will make a chart illustrating each type. B. Students will insert the name of each person who assumes the role illustrated on the preceding charts.
6. Executive Responsibilities: The president must participate in the planning, organization, staffing, directing and controlling of the manufacturing procedure. The president is in overall charge of company performance. He carries out policies of the board of directors. To succeed in this, he coordinates the efforts of the various departments through his vice presidents.	A. The president works with the various departments and schedules procedures. B. The president will call and chair meetings of the board of directors and the executive committee. C. The vice presidents of various departments will give reports of their activities at the board of directors meetings and executive committee meetings.
7. Span of Control: Most manufacturing industries are broken down into various functional areas. They are: Personnel - insures that all positions are filled by competent personnel and trains them to their full potential, also arranges for compensation and evaluation measures. Research and Development - works on the design and working drawings, etc., of the product and jigs and fixtures.	A. Each department is to develop charts, drawings, record sheets, as becomes necessary. B. Personnel will prepare employment forms, interview prospective candidates, and design evaluation sheets for merit rating. (Refer to conceptual development on Personnel.) C. Research and development (R & D) will develop all drawings - working drawings, isometric jigs and fixtures drawings, and work in coordination with production. (Refer to the conceptual development on R & D).
Finance and Control - raises the necessary capital (monetary), controls all receipts and expenditures, distributes profits and pays back loans with interest.	D. Finance and control (F & C) will prepare stock certificates, prepare budgets, and records all financial aspects of the company. (Refer to conceptual development on F & C).

DEPARTMENT: Corporate Organization

Sub - concepts (understandings to convey)	Suggested Student Activities
Production - implements procedures and processes and acquires that which is necessary for actual production.	E. Production will coordinate efforts with R & D and obtain necessary tools and machines for production. (Refer to the conceptual development on production.)
Marketing - determines product saleability, controls sales and distribution.	F. Marketing will research the potential market (through interviews, questionnaires, etc.) and relate this information to the various departments. (Refer to the conceptual development on marketing.)

DEPARTMENT: Personnel

CONCEPT: The personnel department is concerned with developing and administering policies and programs that provide for an effective organizational structure, qualified workers, equitable treatment and job satisfaction.

Sub - concepts (understandings to convey)	Suggested Student Activities
A. Personnel is concerned with insuring that all positions are filled by qualified personnel at reasonable cost.	1. The dept. will develop an employment form to be used as a gauge to position students in the departments. 2. Dept. will hold job interviews. 3. The dept. will position students in management and working positions in order to balance the manpower needs of the company.
B. The personnel dept. is concerned with opening communication channels for passing information to employees, analyzing personnel techniques and problems for the purpose of recommending organizational changes and developing means of evaluation of workers.	1. The students will choose V.P.'s to issue information to employees in all depts. 2. The personnel students will make studies as to how the other students work in the organization and will suggest changes to better the organization. 3. The students of personnel will develop a merit rating system as a means of evaluating each employee's performance. 4. Personnel dept. will conduct tours of facilities. 5. Students will prepare news releases for paper. 6. Students will make displays in school.
C. Personnel is concerned with training existing personnel to their full potential for attaining established performance standards.	1. The dept. will work closely with production in developing a training program for employees. 2. The personnel students will prepare a safety policy and also a safety program to insure worker safety on the job. 3. The personnel dept. will develop a maintenanc (clean-up) policy and procedure which all students will participate in.
D. The personnel dept. must make sure that all employees are fairly and equitably compensated.	1. The dept. will establish a policy for paying each worker. (The rating system could be used for evaluation purposes.)

DEPARTMENT: Personnel

Sub - concepts (understandings to convey)	Suggested Student Activities
	2. The dept. will establish a policy for paying overtime to workers. 3. The dept. will set-up a recording system for attendance, hours worked, overtime, etc.
E. Personnel must insure that the working relationships between management and employers and job satisfaction and work opportunities are developed and maintained.	1. The dept. will develop a grievance system to handle complaints. 2. The dept. will develop a suggestion system for ideas to better the company.
F. Personnel maintains the general welfare of of employees and assists them with problems related to the company.	1. The students will brainstorm ideas for student services. (Example: recreation, food & snack breaks, etc.)

DEPARTMENT: Research and Development

CONCEPT: The area of research and development is concerned with applying the techniques and operations of science and technology to create products and services which will benefit an enterprise.

Sub - concepts (understandings to convey)	Suggested Student Activities
A. The research function of R & D finds new uses for products, develops new products, develops tests for products and improves old products.	1. Each student will research and list new products on the market. 2. Each student will list several uses for each product. 3. Each student will suggest several new improvements for each product.
B. The role of design is that of creating a product that fulfills a function and has aesthetic appeal. Model construction is a good function of design and a good warm-up for 3-D development.	1. Each student will list functional design requirements for each product idea. 2. Each student will design and sketch a product and some variations of it. 3. The students will construct models of their ideas. 4. The class will constructively criticize these ideas.
C. Transforming working drawings into 3-D prototypes is a basic step in developing a better designed final product and also saves time and labor in the final analysis.	1. The students will construct a prototype. 2. The dept. will design jigs and fixtures and make working drawings of same.
D. The testing of design effectiveness, material selection and processing of a product against pre-established standards of acceptability is essential in R & D.	1. The students will perform tests on the prototypes to see if it meets with requirements already established. 2. The students will perform a market research on the product and present the results to the class. 3. The class will select the final product for production. 4. R & D will draw working drawings of the product and components.

DEPARTMENT: Finance and Control

CONCEPT: The functional area of finance and control is concerned with securing adequate operating funds at minimum cost; maintaining records and preparing reports to measure the results of company operations; and providing accounting services structured for use by managers in planning and controlling the business.

Sub - concepts (understandings to convey)	Suggested Student Activities
1. Corporate Financing: The availability and scheduling of capital is essential to providing the materials, facilities, and personnel for production.	A. Capitalize the student company by issuing stock. Option: Encourage students to regularly review the financial section of a local or national newspaper. (Note - top management is doing its homework by reading the financial section religiously). Option: The students may print up a booklet called a prospectus that tells potential stockholders about their company - what the company is, what it makes, and why they think it is a good investment.
2. Budgeting: The financial success of a manufacturing plant is dependent upon accurate projections of anticipated expenditures as balanced against anticipated income. The budget functions as a guide for and control over financial operation of the total plant complex.	B. The department head (V.P.) and assistant will prepare budget forms and the president will instruct each department to fill out a form stating their financial needs and return it to finance and control. Option: Arrange for student council president to outline estimated expenditure of council for sports, field trips, entertainment, etc.
3. Since promise of a profit attracts investors a business must regard profits as a fundamental goal. "Profit" making a reasonable product in exchange for a reasonable price, and give a reasonable return to the investor.	C. Buy a product at wholesale price and sell it with the usual mark-up. (Possibilities - case of coke, ball point pens, lapel buttons, pencils, etc.)
4. Every business needs capital. Before an item is produced the business must have machines, furniture, power, raw materials, light, workspaces, tools, supplies, heat, fixtures, equipment, insurance and working cash to finance receivables. Sources of money or capital for initiating or stimulating	D. Bring in a broker or a bank manager to speak to the class on this topic. Option: Assign a reading from text or reference book discussing capital financing.

Sub - concepts (understandings to convey)	Suggested Student Activities
business: (a) stocks, (b) loans, (c) savings, (d) long term credit, (e) intermediate credit, (f) short term credit.	
5. Every corporation needs to know how many products will have to be produced before it becomes solvent and also gains a respectable profit. The break-even chart provides the means of accomplishing this.	E. Use graph paper and construct a break-even chart. Option: Invite a finance dept. personnel from a local plant to discuss this topic.
6. The student company, as well as any corporation, must develop the means for control of finances.	F. Open a checking account at the local bank. -set up a general ledger -prepare: balance sheets, profit and loss statements Option: Set up a simulated checking account with the teacher as the bank.
7. A corporation must plan wisely for the usage of its capital within the business.	G. Prepare a break down to show where the money goes. (e.g., buildings, machines, wages, storage, marketing).
8. Liquidation is the cessation of operations whether voluntary or involuntary.	H. Payment of liabilities and distribution of assets.
9. The various departments are responsible for informing the president and board of directors of transactions or happenings by weekly reports.	I. Finance students will prepare weekly reports, either oral or written in nature, to be given to the president and board of directors.
10. Every business has a responsibility towards the community, namely, that the business will employ ethical trading practices, deal honestly, advertise truthfully, contribute to the nation's economy and pay their share of the tax burden.	J. Students may question people in the community to find out how these citizens feel about companies in the community.

DEPARTMENT: Production - Quality Control

CONCEPT: The area of production is concerned with developing the most economical method and plans for manufacturing products; coordinating manpower; securing and coordinating materials, facilities, and tools; and producing products.

Sub - concepts (understandings to convey)	Suggested Student Activities
A. The production dept. will assist in training of employees to facilitate the flow of production.	1. The students will work with personnel closely to develop a training program.
B. Product engineering is concerned with modifying the product for manufacturing and marketing purposes in regards to performance and quality characteristics.	1. The dept. will draw a set of assembly drawings. 2. The dept. will implement design changes when needed. 3. The dept. will draw up a process chart for each component.
C. Industrial engineering deals with the planning and utilization of men, facilities, tools, jigs and fixtures, to attain the prescribed quantity and quality at a minimum of cost and labor.	1. The dept. will draw up a floor plan for uses of a flow chart. 2. The dept. will develop a flow of materials chart for showing line of production, processes, operations, inspections, storage and assembly. 3. The dept. will construct jigs and fixtures according to specifications of drawings by R & D. 4. The dept. will set up machines in shop, according to flow chart. 5. The dept. will list hand tools available to the company.
D. Quality control is concerned with establishing of acceptable limits for the product and implements inspection procedures used to insure that all facets of the materials and product meet the accepted limits.	1. The students will develop various inspection methods for each part of the product. 2. The students will develop gauges (Go-Nogo) for inspection of parts. 3. The students will inspect all purchases of raw materials for defects. 4. The students will inspect by either random selection or continuous piece inspection. 5. Quality control will conduct time studies and work measurements.

Sub - concepts (understandings to convey)	Suggested Student Activities
	6. Quality control will recommend changes to production on the basis of these studies.
E. Purchasing involves obtaining materials, supplies, services and equipment when needed at a minimal cost to the company.	1. Purchasing will develop a policy with F & C for securing supplies and materials. 2. Purchasing will develop necessary forms for requisitioning supplies. 3. Purchasing will look for and select suppliers that will cater to the company. 4. Purchasing will expedite orders and keep records of transactions.
F. Production planning and control is the preparing, issuing and encouraging compliance with schedules of men, materials and facilities required to complete manufacturing so products and components will be ready when needed.	1. P P & C will maintain inventories of supplies. 2. P P & C will investigate schedule compliance. 3. P P & C will coordinate all data from purchasing, industrial engineering and quality control, and report results to executive committee meeting.
G. Manufacturing is the making of products for sale by changing shape, composition, or combination of materials, parts or sub-assemblies.	1. Production/personnel depts. must see that all workers are thoroughly trained and familiar with their jobs. 2. Production will conduct a pilot run to check for bottlenecks and problem areas, rework, redesign, retool, etc. 3. Production manufacturing will conduct a production run.

DEPARTMENT: Marketing

CONCEPT: The functional area of marketing is concerned with directing and encouraging the flow and sale of goods from producer to consumer or user.

Sub - concepts (understandings to convey)	Suggested Student Activities
A. Market Research: The role of market research is to measure and evaluate customer needs and wants. They also obtain and record information relating to customer reaction as to prices and specifications. They determine the extent of the market.	1. Marketing dept. will assess the characteristics of the market. 2. During preliminary market research students will prepare a questionnaire to find out which type of products (prototypes) developed would have good saleable aspects. 3. Students will report their findings to the board of directors (or, class, if company is not formed yet) and suggest the product with the most appeal to the market. 4. Students will prepare a market research form on the prototype. 5. Students involved with this area will circulate the questionnaire and record results. These results are then summarized. 6. Students then recommend to R & D what changes, if any, should be made.
B. Advertising: Advertising is the coordinated persuasive communication between the producer (or sponsor) and consumer for the purpose of increasing the product sales and promoting a better corporate image.	1. Students prepare an advertising budget. 2. Students plan their advertising campaign. 3. Marketing dept. will plan and prepare the advertising media. 4. Invite in a resource speaker to discuss the area of advertising with the class.
C. Distribution: Marketing is also responsible for the moving and handling of products from the point of storage to the point of sales.	1. Keep a running inventory of items on hand and the items that are sold. 2. Prepare a storage location. 3. Receive and inspect the finished products. 4. Make up orders. 5. Select the most appropriate means of transporting the product to the consumer. 6. Deliver the products.

DEPARTMENT: Marketing

Sub - concepts (understandings to convey)	Suggested Student Activities
D. Sales: The actual selling of the product with the profitable transfer of the product between the producer and the customer.	1. Students can make up advance order forms and take advance orders. 2. Preparation of the price list. 3. Students will design and prepare price tags. 4. This dept. could train, direct, and compensate their salesmen. 5. Students will sell their product. 6. Students must keep records of all sales. (This is most important).
E. Packaging: Packaging is frequently necessary in order to prepare a product for handling, storage, identification, protection, and make it more attractive and saleable through effective design and display.	1. The students will discuss the functional requirements with the teacher, other depts., and/or the board of directors. 2. The students will determine the requirements that would aid the sales of the product. 3. The students will develop the package specifications. 4. The students will now test the package to determine whether or not it meets the specifications. 5. The students may bring in different types of packages to discuss how they protect the product and how the package aids the product saleability.
F. Service: The servicing of products attempts to assure customer satisfaction and reasonable product performance through the development of service contracts, guarantees, operating procedures, maintenance, and credit plans.	1. The students will develop directions and service instructions for customers. 2. The students will determine a guarantee for their product. 3. The students will train customers or service personnel, if necessary. 4. The students will honor its commitments to their customers. 5. If possible, invite a local company serviceman to discuss this area with the class.

POSSIBLE PROBLEMS AND SOLUTIONS

During the implementation of this program, there are some areas that reveal inherent difficulties. This section is designed to help in alleviating these areas. Drawing from the experiences of the Pilot Program student teachers, five main areas were found to be of common difficulty in each teaching experience. These five areas were: 1) The motivation of the students during the initial phase of the program; 2) The lack of technical background of Junior High School students; 3) Product determination by the company; 4) Understanding the concept of jigs and fixtures; and 4) The simultaneous occupation of students in their departmental roles. The following paragraphs will offer solutions that might help the instructor to keep the student company proceeding efficiently.

Possible Problems: During the initial phase of the program difficulties might appear in motivating students and developing their interest in the program.

Suggested Solutions:

A. A small mass production unit such as that described in the following section is a good motivational tool. This will present to the students the concepts of mass production, division of labor, materials flow, etc. This will not only develop interest among the students, but will enhance their knowledge of production and production tooling, to be recalled upon for later duties within the company.

B. Audio-visual aids are of extreme value during the initial phase of the program. A list of good aids is included in the Resource and General Bibliography section.

C. The use of an outside resource speaker is of infinite value. In the opening stages, continuous group lessons tend to make Junior High students restless. New faces and personalities tend to motivate students and increase their interest. For example, for a lesson about personnel, the personnel director of a local industry could be engaged to speak; in the area of finance, perhaps a banker; in R & D, perhaps an instructor of art or design. In any case, the number of resources is infinite. Do not overlook the possibility of engaging the students' parents to participate in the program.

D. Field trips to local industries can be a valuable motivational tool. If the students can observe a good example of manufacturing in progress, and they are well-prepared for the trip by the instructor, much will be gained by them from this experience. They will be able to relate to this throughout the program.

Possible Problems: The lack of technical skills may also cause difficulties within the program.

Suggested Solutions:

A. Mini technical lessons are a good way to eliminate this problem of lack of skills. Using this technique the students are shown a list of ways to complete different operations. For example, the operation could be cutting a board. Then the students would be shown numerous ways to complete the operation: hand, table saw, radial saw, etc. By these lessons of superficial depth the students can grasp basic technical aspects needed in production and later recall these when needed. Then a more in depth instruction could be given to the student. A handout listing the various ways of completing operations would be helpful.

B. After these mini lessons are given, performance drills would be a good follow up. The students could work on their own or in teams, and would be able to develop technical skills. This idea would depend on how much time is available within the program.

Possible Problems: The difficulty with product determination is to be able to draw out of the students fresh and original ideas for products.

Suggested Solutions:

A. Brainstorming, when carried out in the correct manner, can be an effective method in product determination. However, many times it is not used correctly. There should not be any limitations on the ideas from the students. The wilder the idea the better. It's always easier to tone down an idea rather than to build it up. Also, the students have a tendency to criticize ideas during the brainstorming session and this is not advisable. The students should be instructed to make no negative comments about the ideas presented in brainstorming. From these ideas, many times the basic idea for the product is developed.

B. Another method would be to give the students different sample project books available in the shop. Also, good sources for product ideas are different mail order catalogues, such as Sears or Wards. Another good source is the gift shop catalogues, which have numerous ideas that the students might like to use. Past products made by previous classes might also stimulate the students thinking. However, the problem with this is that the students tend to cling to the original idea. The instructor should stress the idea of improvements and changes that should be made to make the company's product unique on the market.

C. One further method to stimulate interest in product determination is to have the students construct models of ideas and present these ideas to the entire class. This will give the students experience in technical areas and also give him a role to play in "selling" his idea to the board of directors.

Possible Problems: The students tend to have difficulty in grasping the concept of jigs and fixtures.

Suggested Solutions:

A. Again, the Mass Production unit proves to be a valuable tool in not only motivating the students, but also as an excellent example of jigs and fixtures. The units described in the following section are excellent examples. Of course instruction about jigs and fixtures should accompany this unit.

B. Enlisting the services of a guest speaker who has experience in this area is not to be overlooked. Perhaps a college instructor or a worker who uses jigs and fixtures on his job could talk to the class. If this person were to bring some examples and demonstrate their uses, this would be to the students advantage.

Possible Problems: Keeping all departments working simultaneously throughout the program may present difficulties.

Suggested Solutions:

A. One necessity, if a department is to operate efficiently, is that there should be a well thought-out and detailed job description form. This should be done by the students themselves, after lessons by the instructor and research by the student into the area is completed. These descriptions should outline completely the duties of each member of the department.

B. Another way of insuring the direction of each department is to give individual lessons to the separate departments, instead of large class lessons. This technique lends itself to injecting more detail into the lessons and less formalities between instructor and student. Also, a better dialogue and rapport can be developed among the students themselves and the instructor.

C. One other innovation to keep the company running smoothly, is that of weekly or bi-weekly executive committee meetings. In this way, students and vice presidents may be reminded of their duties and the departments can be kept running smoothly. Role playing by the students plays an extremely important part in these meetings and should be encouraged. These meetings also help to keep the instructor informed as to the direction the departments are going and whether they are functioning efficiently.

D. The Student Guides/Self-Study Modules were developed to give direction to each functioning area of the student company and free a good deal of the teachers time for overall coordination.

PART IV

SAMPLE MASS PRODUCTION UNIT

R. Logan
M. McGuire

INTRODUCTION

The purpose of this section is to give you, the teacher, assistance in introducing the topic of "manufacturing," into your Industiral Arts program. The unit will serve as an excellent method for motivating your students and will provide them with an initail experience upon which to draw during their class company's operation. This section contains two different mass production runs, one for metal, which is a candle holder, and one for wood, which is a spinner top. You may choose either, depending on your facilities.

Each of these mass production runs can be completed in a few class periods. All working drawings for the parts of the candle holder and spinner top are given on the following pages of this unit. Drawings of the jigs and fixtures used for the mass production run are also provided so that you may construct them PRIOR to the mass production run. However, you may choose to give these drawings to your students and let them make the jigs and fixtures.

This mass production run will expose the students to special tooling (jigs and fixtures) and to mass production techniques. The experience gained from this activity will be very valuable when production tooling is discussed in your manufacturing program because the students will already have been exposed to the effective use of jigs and fixtures.

TOOLS & MACHINES NEEDED

SPINNER TOP

Handle

back saw
hand drill or drill press
9/32 drill

Dowel

back saw
hand drill or drill press
3/32 drill
disc and belt sander

Disc

drill press
hole saw - 1/4 dia. center drill
1 3/4 inside dia.

String

light weight string
scissors
hot plate or other source of heat
measuring device

CANDLE HOLDER

Base

squaring shears
drill press
#51 drill
soldering gun

Side

squaring shears
spot welder

MATERIALS NEEDED

Handle

3/4 in x 1 in soft wood strips

Disc

1/2 in x 2 1/4 in soft wood strips

Dowel

1/4 in diameter

String

paraffin or fast drying lacquer

NOTE: All strips of wood are to be tested by the teacher prior to the mass production run. This is to eliminate possible problems of materials not fitting the jigs and fixtures.

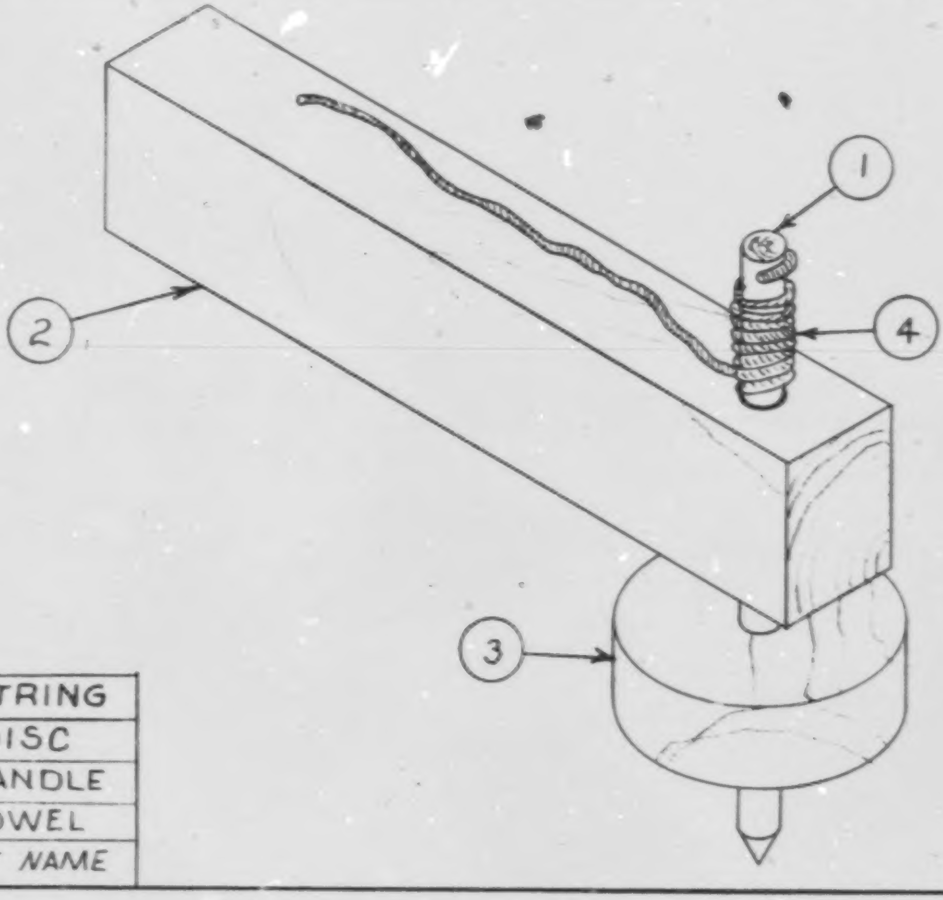
Base

equilateral triangle (4 1/2 in per side)
tin plated steel (30 gauge)
1 in finishing nails
paint

Side

7 1/2 in x 2 in perforated steel
(22 gauge)

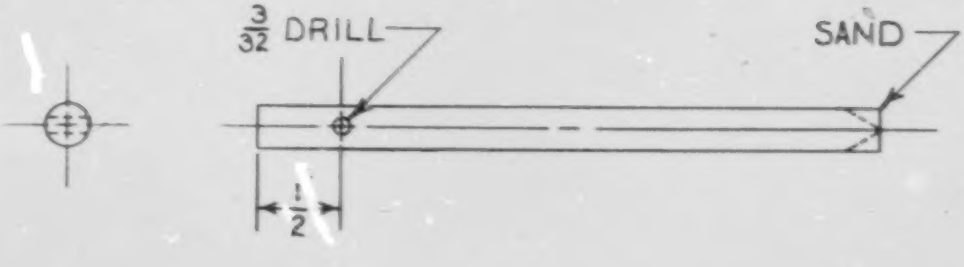
NOTE: After bending the base (90 degrees) on the bending fixture use a 3/8 in dowel and bend the tips around underneath all the way. Any of these jigs and fixtures can be altered to suit the instructor's needs.



PRT	PRT NAME
/	DOWEL
2	HANDLE
3	DISC
4	STRING

① DOWEL

$\frac{1}{4}$ DIA × 3 $\frac{3}{4}$



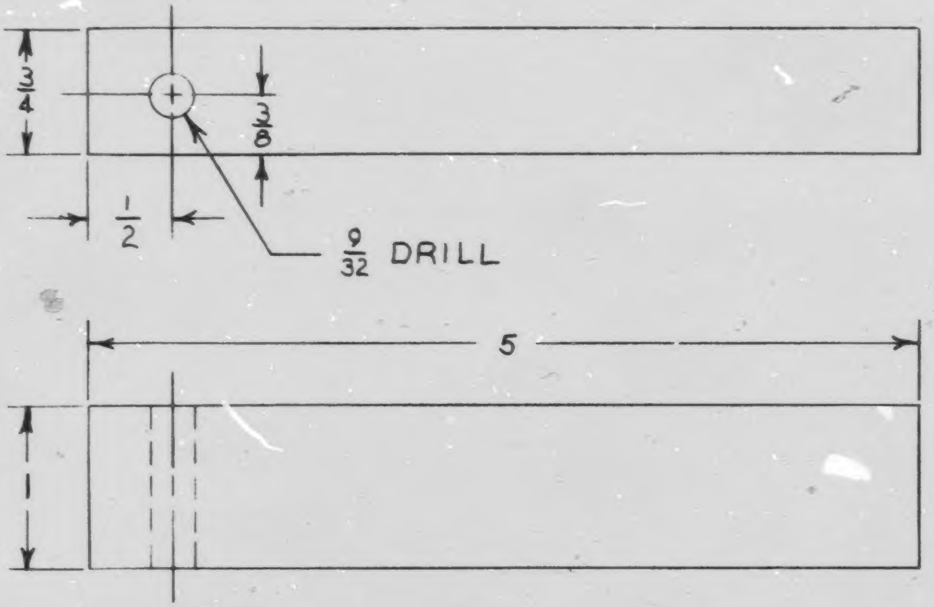
PART NO.
DWG NO. 1
PILOT PROGRAM
APPR
DATE /-72
DWN BY R.W. LOGAN
NO.
IA LAB
SECT

STATE UNIVERSITY COLLEGE
OSWEGO, NEW YORK
DRAWING AND PLANNING LABORATORY

PART NAME SPINNER TOP
ASSY NAME FINAL ASSEMBLY
MATL PINE
SCALE: FULL
ASSY NO.
FIN NONE
HT TR

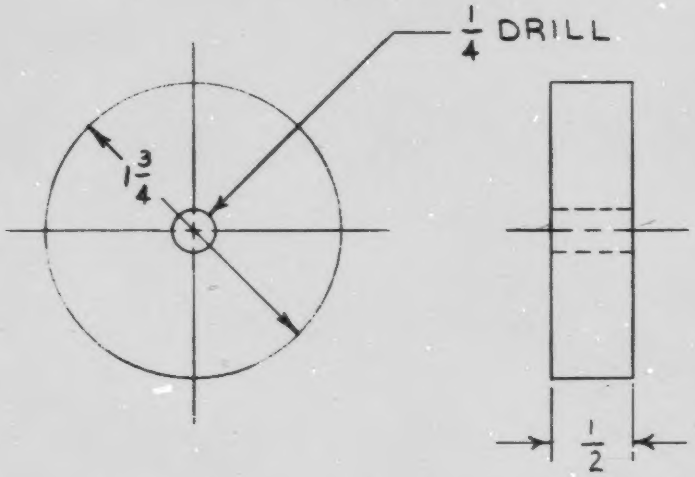
F POST CO 178-H 50110

② HANDLE



3/4
3/8
1/2
9/32 DRILL
5
1

③ DISC



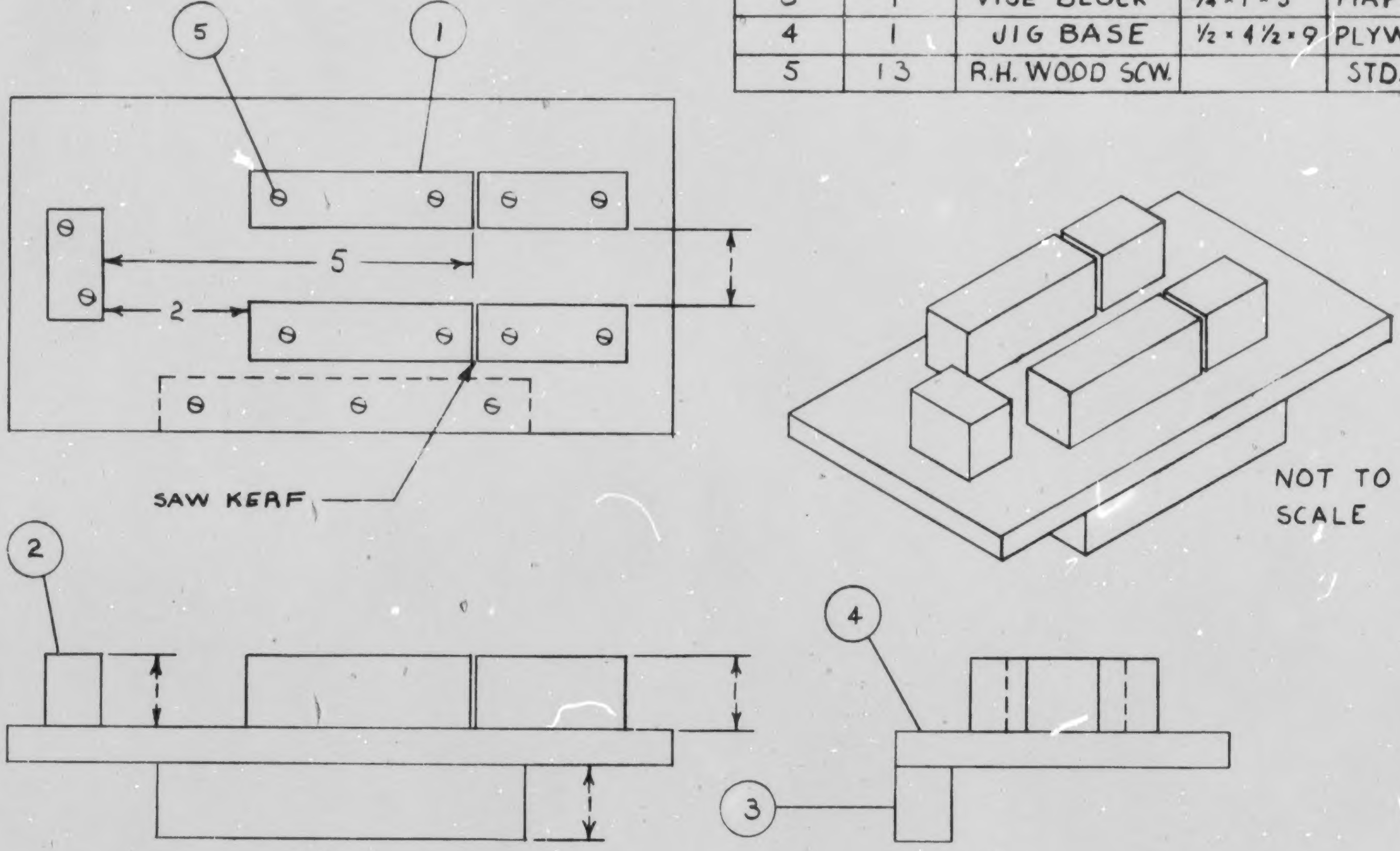
1/4 DRILL
1 3/4
1/2

ASSY NO.	FIN NONE	HT TR
ASSY NAME	MATL PINE	SCALE : FULL
PART NAME HANDLE & DISC	**STATE UNIVERSITY COLLEGE** OSWEGO, NEW YORK	DRAWING AND PLANNING LABORATORY
DATE 1-72	DWN BY R.W. LOGAN	NO. IA LAB
APPR		SECT
PART NO.	DWG NO. PILOT 2 PROGRAM	

F POST CO 175-H 90110

NOTE: MAKE SAW KERF AFTER JIG IS ASSEMBLED TO ASSURE ACCURACY

PRT. NO.	NO. RQD	NAME	SIZE	MATL
1	2	SIDE GUIDE	3/4 × 1 × 5	MAPLE
2	1	STOP BLOCK	3/4 × 1 × 1 1/2	MAPLE
3	1	VISE BLOCK	3/4 × 1 × 5	MAPLE
4	1	JIG BASE	1/2 × 4 1/2 × 9	PLYWOOD
5	13	R.H. WOOD SCW.		STD. PT.

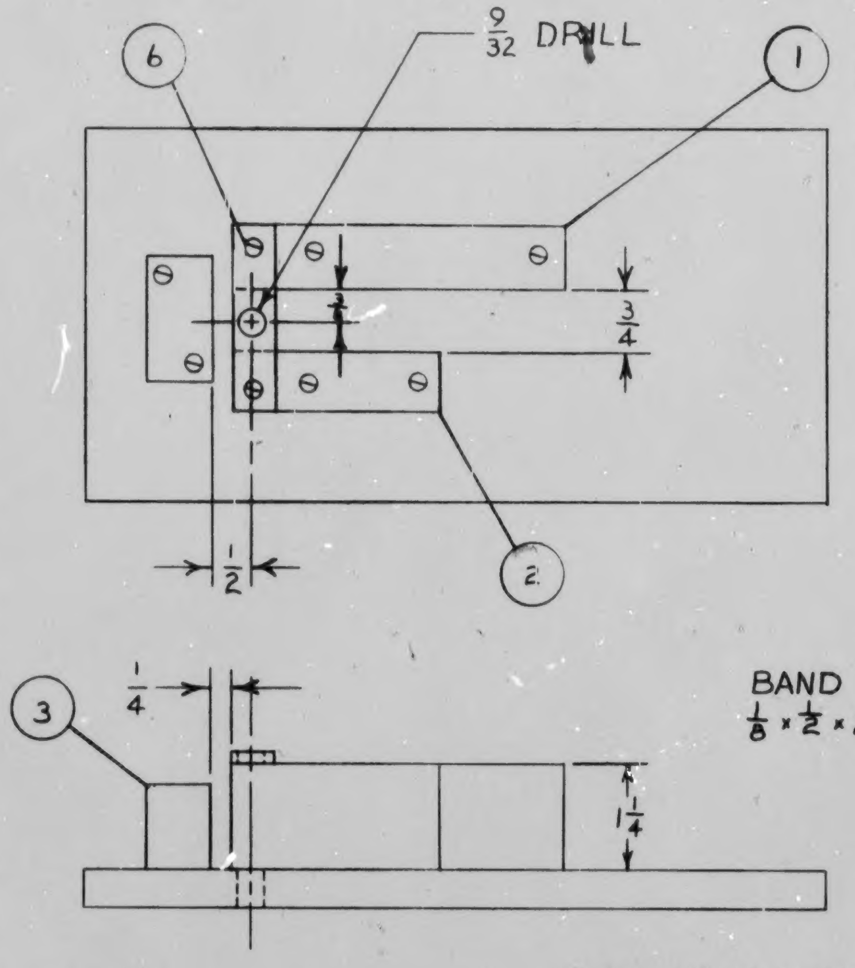


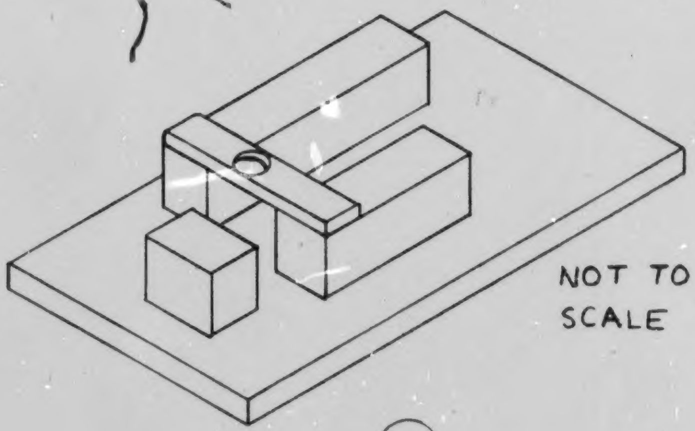
JIG*1 - HANDLE CUTOFF

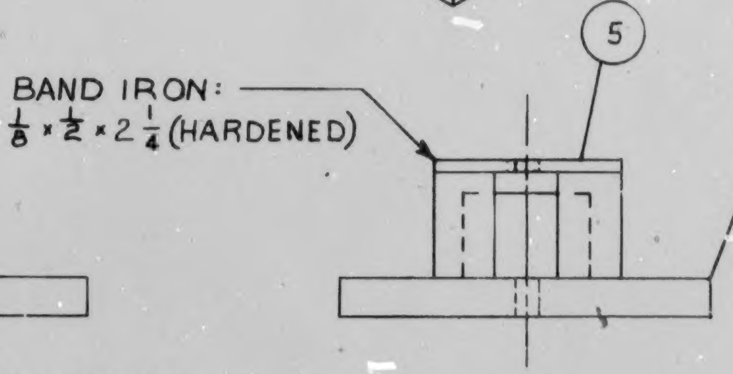
ASSY NO.	ASSY NAME JIG*1	PART NAME HANDLE CUTOFF JIG	DATE 1-72	APPR	PART NO. 1
FIN NONE	MATL MAPLE	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY R.W. LOGAN		DWG NO. PILOT 3 PROGRAM
HT TR NONE	SCALE: 1/2 = 1		NO.	IA LAB	SECT

F POST CO 178-H

PRT. NO.	NO. RQD	NAME	SIZE	MATL'
1	1	SIDE GUIDE	3/4 × 1 1/4 × 4	MAPLE
2	1	SIDE GUIDE	3/4 × 1 1/4 × 2 1/2	MAPLE
3	1	STOP BLOCK	3/4 × 1 × 1 1/2	MAPLE
4	1	JIG BASE	1/2 × 4 1/2 × 9	PLYWOOD
5	1	DRILL GUIDE	1/8 × 1/2 × 2 1/4	BAND IRON
6	8	R.H. WOOD SCW.		STD. PT.


6
9/32 DRILL
1
3/4
1/4
1/2
2
3
1/4
1 1/4


NOT TO SCALE


5
BAND IRON:
1/8 × 1/2 × 2 1/4 (HARDENED)
4

JIG#2 - HANDLE DRILLING

ASSY NO.	ASSY NAME JIG # 2	PART NAME HANDLE DRILLING JIG	DATE 1-72 APPR	PART NO. 2
FIN NONE	MATL MAPLE	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY R.W. LOGAN	DWG NO. 4 PILOT PROGRAM
HT TR HARDEN	SCALE: 1/2 = 1		NO. IA LAB SECT	

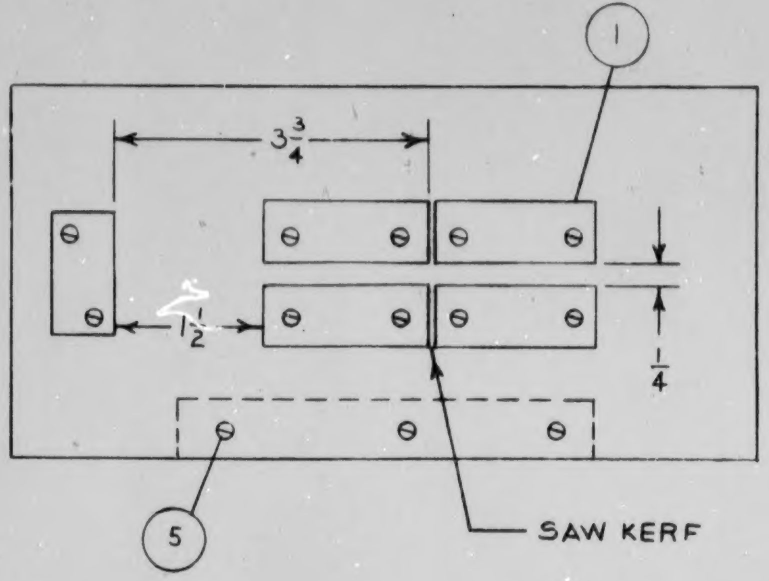
F POST CO 175-H 80110

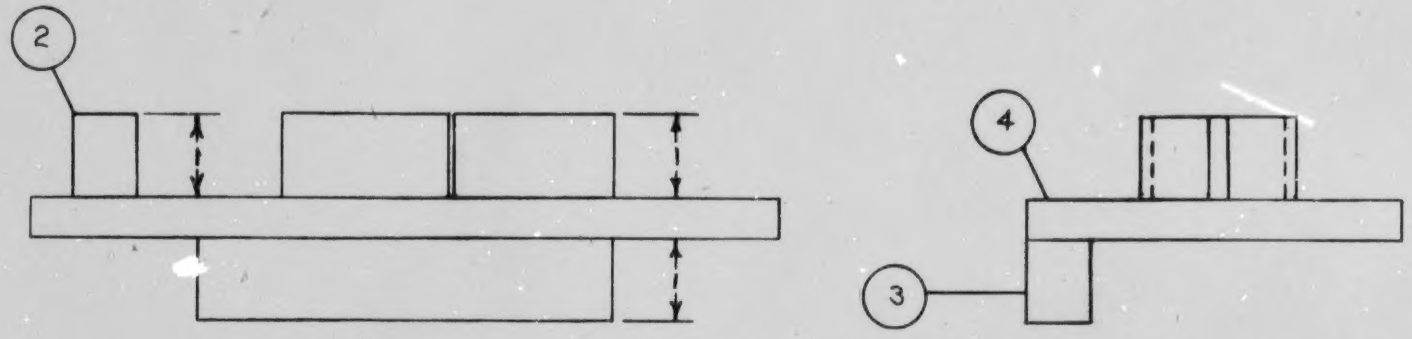
104

NOTE MAKE SAW KERF AFTER JIG IS ASSEMBLE TO ASSURE ACCURACY

PRT. NO.	NO. RQD.	NAME	SIZE	MATL
1	2	SIDE GUIDE	3/4 × 1 × 4	MAPLE
2	1	STOP BLOCK	3/4 × 1 × 1 1/2	MAPLE
3	1	VISE BLOCK	3/4 × 1 × 5	MAPLE
4	1	JIG BASE	1/2 × 4 1/2 × 9	PLYWOOD
5	13	R H. WOOD SCW.		STD. PT.

FOR PICTORIAL VIEW
SEE DRAWING # 3



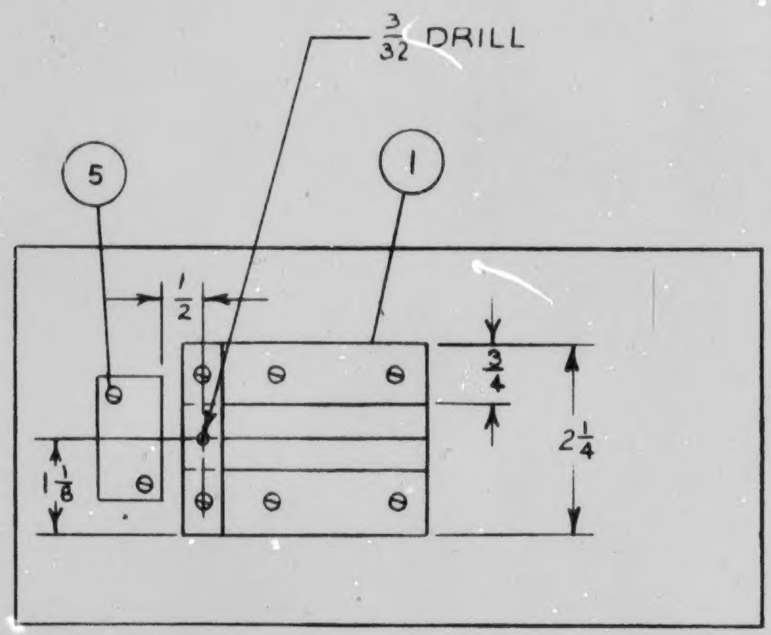


JIG#3- DOWEL CUTOFF

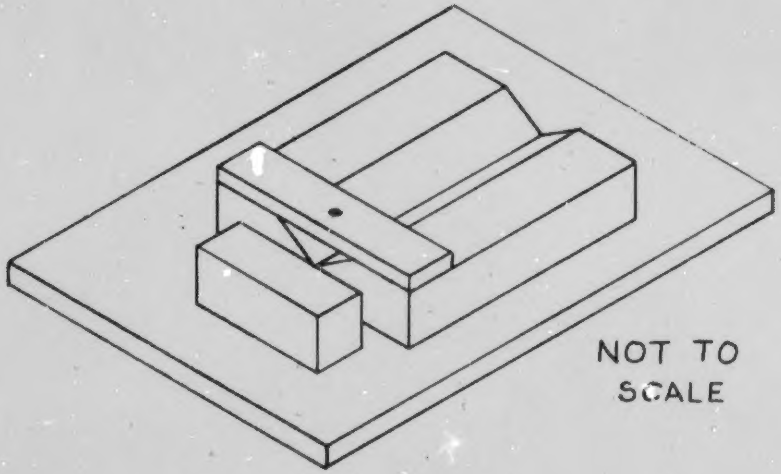
ASSY NO.	ASSY NAME JIG#3	PART NAME DOWEL CUTOFF JIG	DATE 1-72 / APPR	PART NO.#3
FIN NONE	MATL MAPLE	**STATE UNIVERSITY COLLEGE** OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY R.W. LOGAN	DWG NO. 5
HT TR NONE	SCALE 1/2=1		NO. / IA LAB / SECT	PILOT PROGRAM

F POST CO 175-H [illegible]

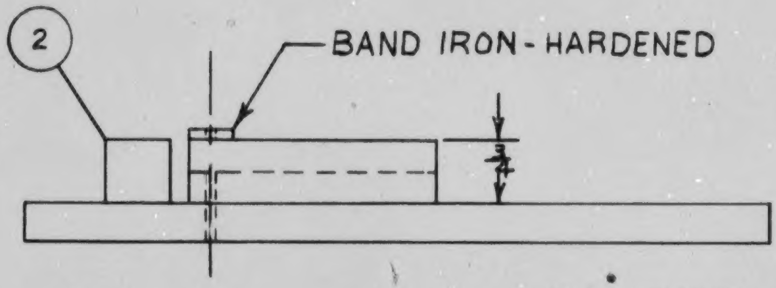
PRT. NO.	NO. RQD.	NAME	SIZE	MAT'L
1	1	V- BLOCK	3/4 × 2 1/4 × 3	MAPLE
2	1	STOP BLOCK	3/4 × 3/4 × 1 1/2	MAPLE
3	1	DRILL GUIDE	1/8 × 1/2 × 2 1/4	BAND IRN
4	1	JIG BASE	1/2 × 4 1/2 × 9	PLYWOOD
5	8	R.H. WOOD SCW.		STD. PT.



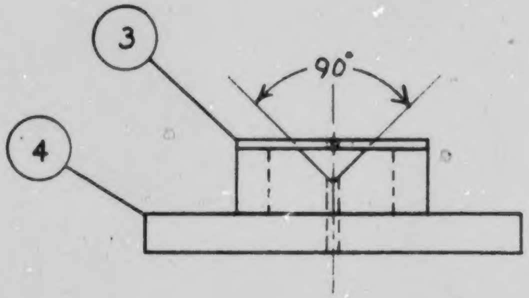
$\frac{3}{32}$ DRILL
5
1
$\frac{1}{2}$
$\frac{3}{4}$
$2\frac{1}{4}$
$1\frac{1}{8}$



NOT TO SCALE



2
BAND IRON - HARDENED
$\frac{3}{4}$

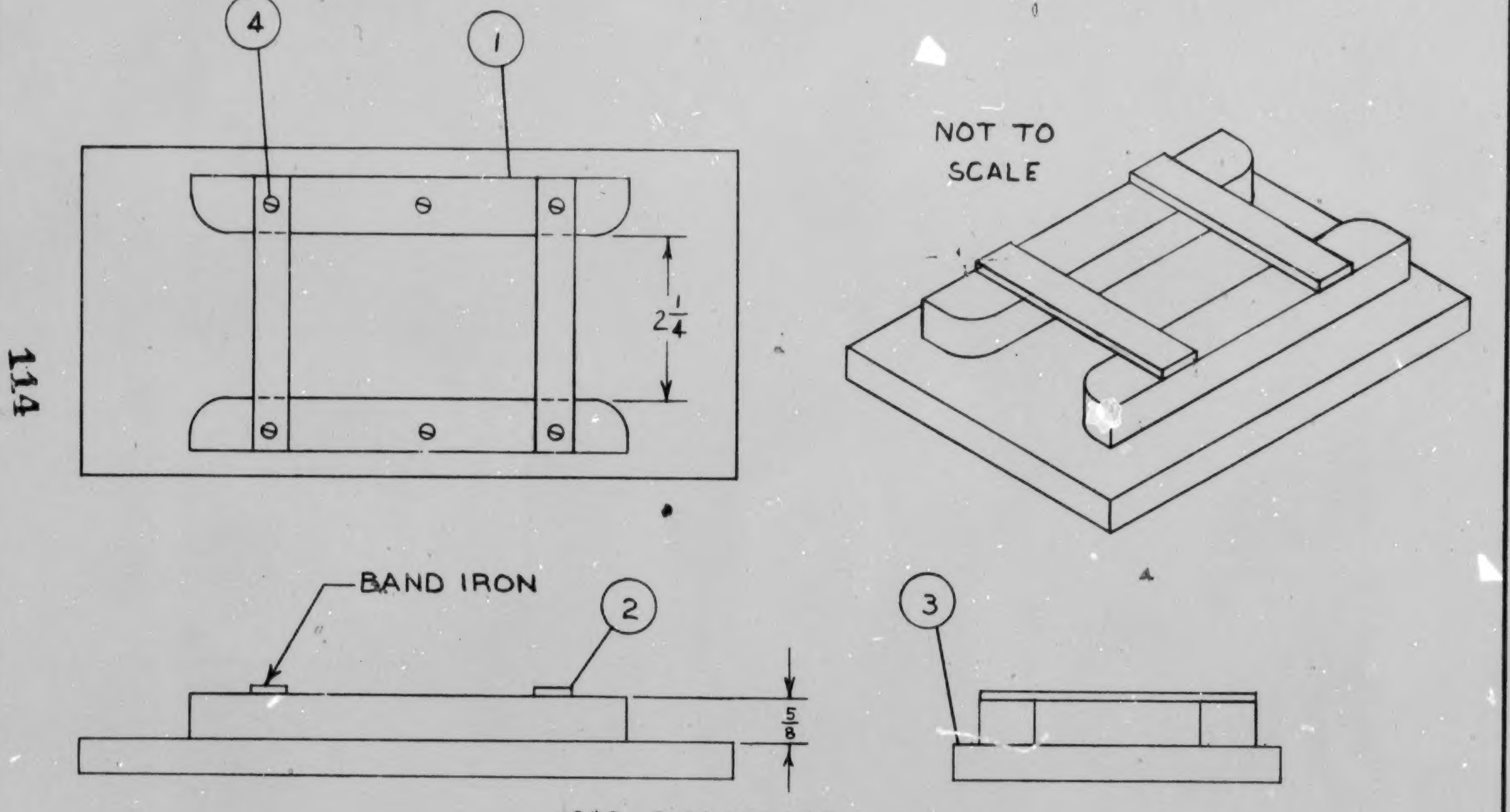


JIG # 4 - DOWEL DRILL

ASSY NO. ASSY NAME JIG # 4	PART NAME DOWEL DRILLING JIG	DATE 1-72	APPR	PART NO. # 4
FIN NONE	MATL MAPLE	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY R.W. LOGAN	DWG NO. 6 PILOT PROGRAM
HT TR-HARDEN	SCALE: 1/2 = 1		NO.	IA LAB	SECT

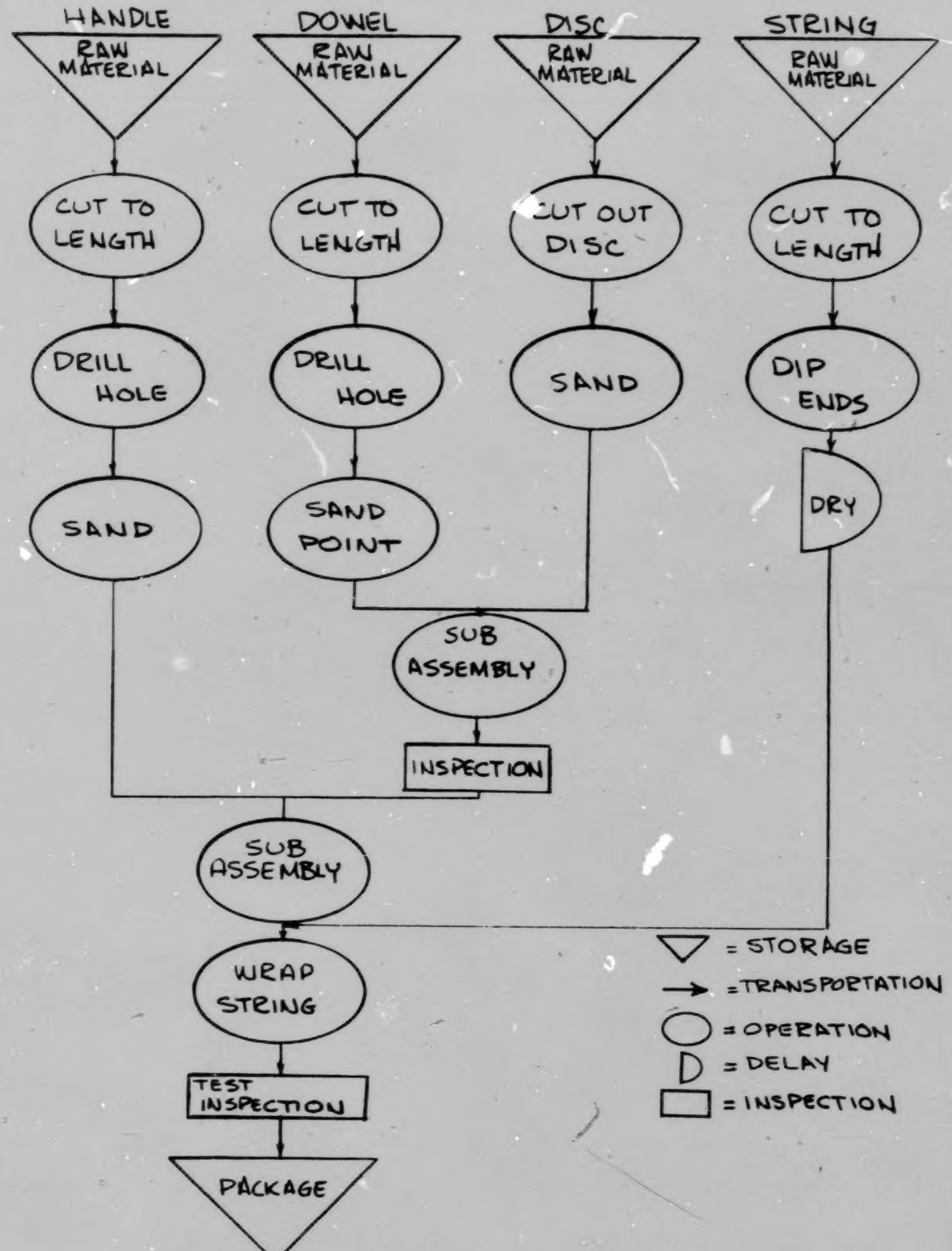
F POST CO 179-H 80110

PRT NO.	NO. RQD.	NAME	SIZE	MAT'L
1	2	SIDE GUIDE	3/4 × 5/8 × 6	MAPLE
2	2	STRAP	1/8 × 1/2 × 3 3/4	BAND IRON
3	1	JIG BASE	1/2 × 4 1/2 × 9	PLYWOOD
4	6	R.H. WOOD SCW.		STD. PT.



JIG*5 - DISC HOLDER

ASSY NO.	ASSY NAME JIG*5	PART NAME DISC HOLDER	DATE 1-72 / APPR	PART NO. 5
FIN NONE	MATL MAPLE	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY R.W. LOGAN	DWG NO. 7 PILOT PROGRAM
HT TR NONE	SCALE 1/2 = 1		NO. / IA LAB / SECT	

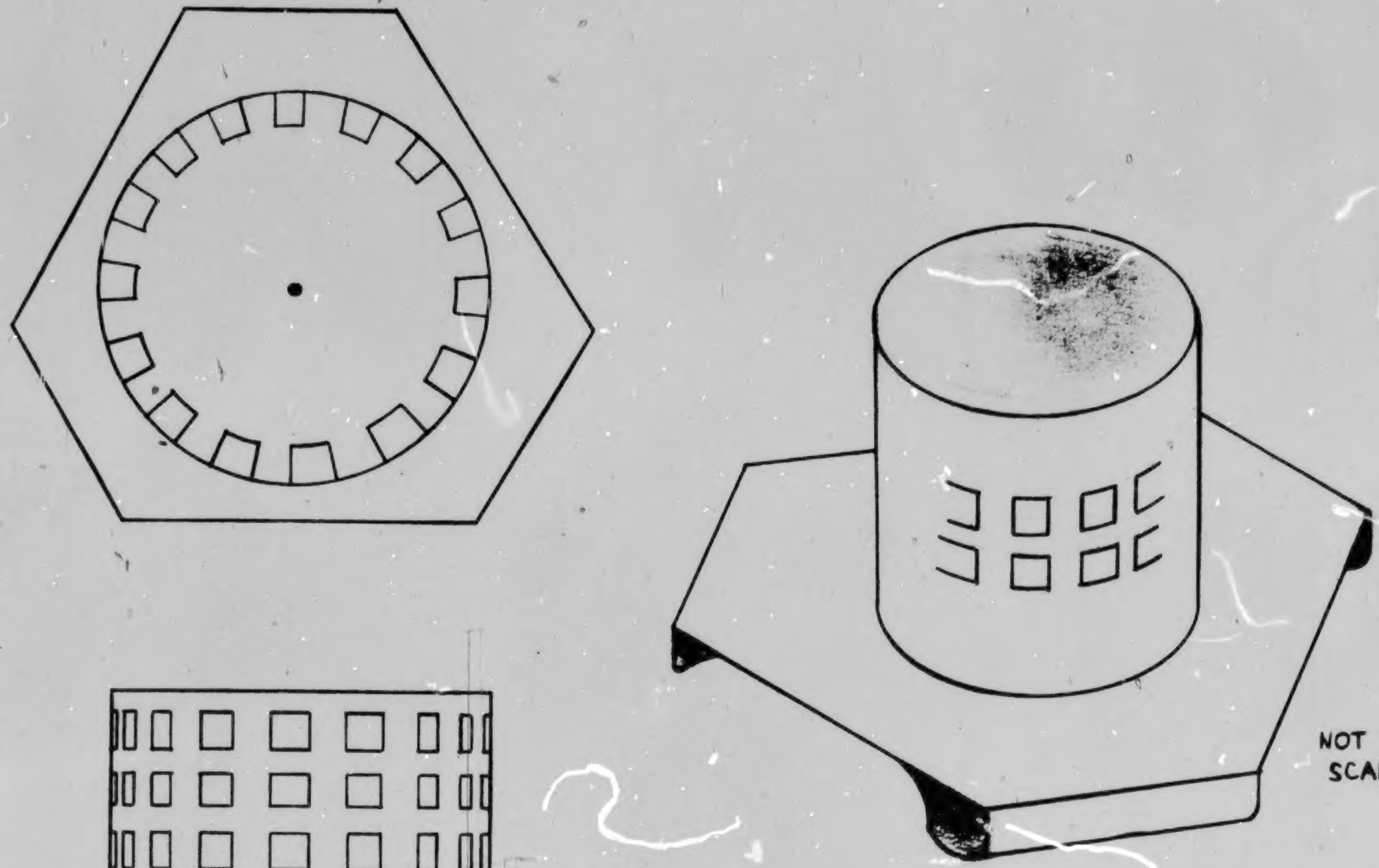

HANDLE
RAW MATERIAL
DOWEL
RAW MATERIAL
DISC
RAW MATERIAL
STRING
RAW MATERIAL
CUT TO LENGTH
CUT TO LENGTH
CUT OUT DISC
CUT TO LENGTH
DRILL HOLE
DRILL HOLE
SAND
DIP ENDS
SAND
SAND POINT
DRY
SUB ASSEMBLY
INSPECTION
SUB ASSEMBLY
WRAP STRING
TEST INSPECTION
PACKAGE
= STORAGE
= TRANSPORTATION
= OPERATION
= DELAY
= INSPECTION

PART NO. [redacted]
PILOT PROGRAM
DATE 1/25/72 APPR
DWN BY D. FIDOTTA
NO. IA LAB SECT

PART NAME PROCESS FLOW CHART

STATE UNIVERSITY COLLEGE
OSWEGO, NEW YORK
DRAWING AND PLANNING LABORATORY

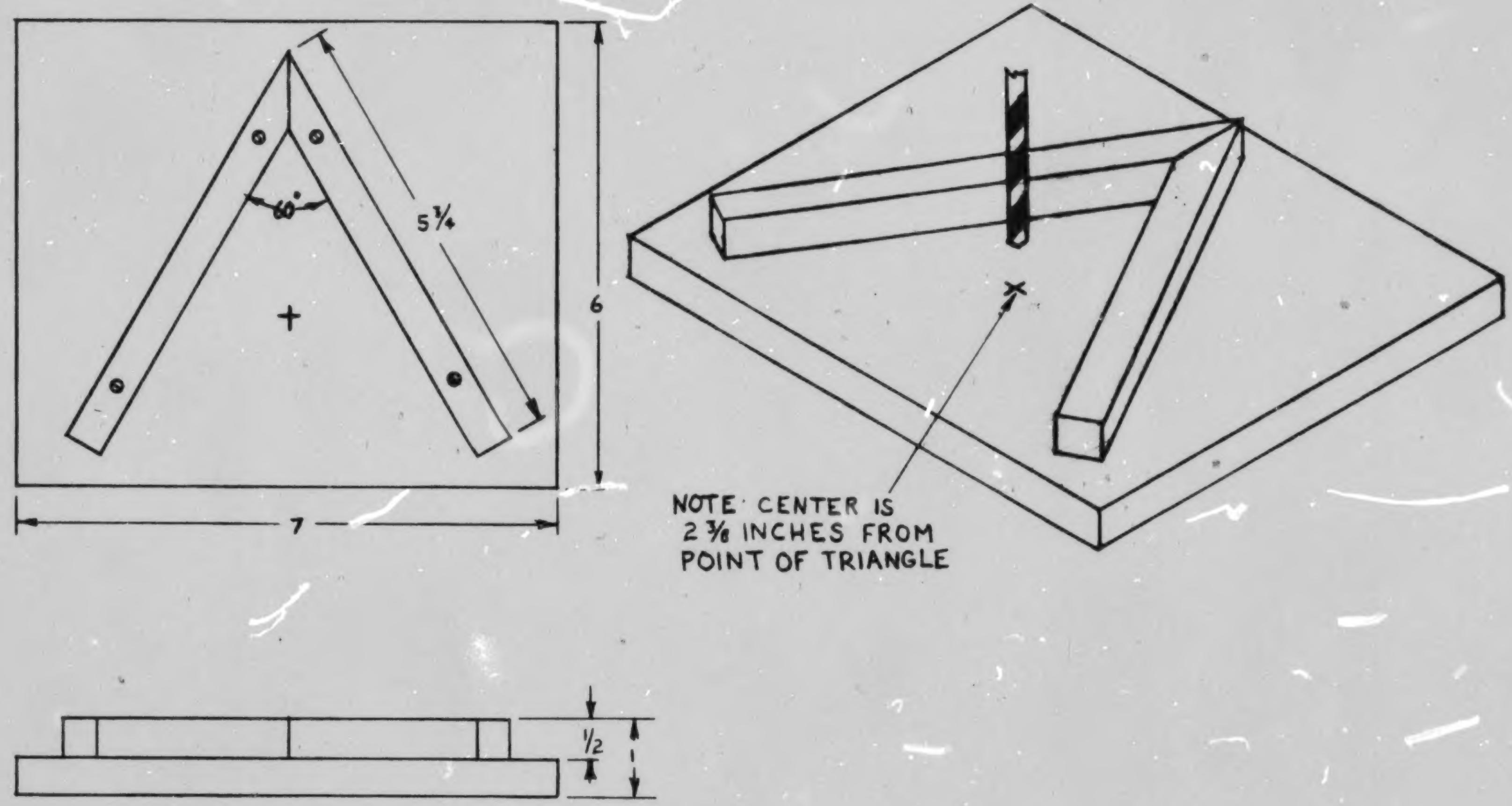
ASSY NO. N/A ASSY NAME
FIN N/A MATL N/A
HT TR N/A SCALE N/A



NOT TO SCALE

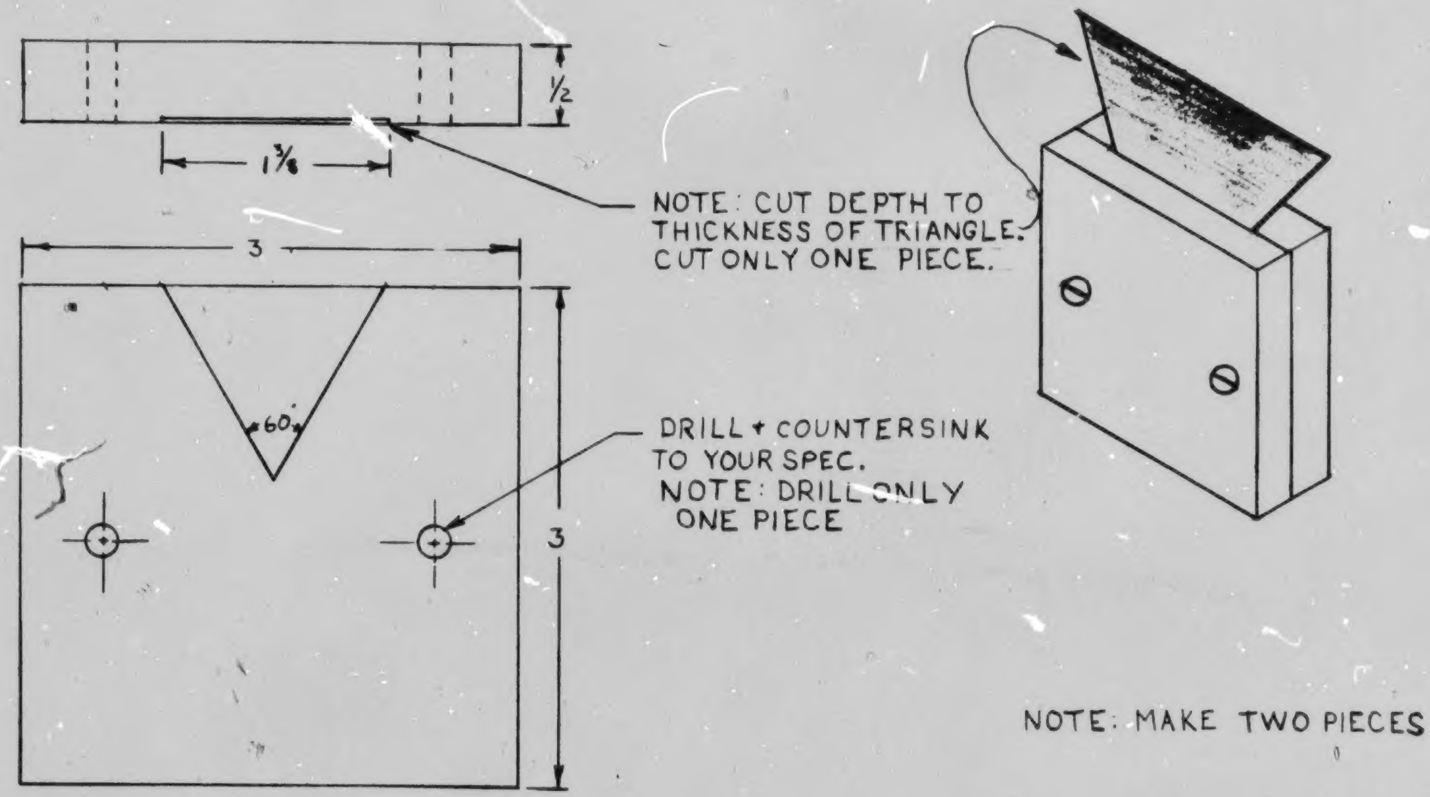
ASSY NO.	ASSY NAME	PART NAME ASSEMBLY	DATE 1/72	APPR	PART NO. [redacted]
FIN	MATL METAL	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY M. MAGUIRE		PILOT PROGRAM
HT TR	SCALE 1:1		NO.	IA LAB	SECT

F POST CO 175-M 80110



NOTE: CENTER IS
2⅜ INCHES FROM
POINT OF TRIANGLE

ASSY NO.	ASSY NAME	PART NAME DRILLING JIG	DATE 1/72	APPR	PART NO.
FIN	MATL WOOD	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK	DWN BY M. MAGUIRE		[redacted] PILOT PROGRAM
HT TR	SCALE ½" = 1"	DRAWING AND PLANNING LABORATORY	NO.	IA LAB	SECT



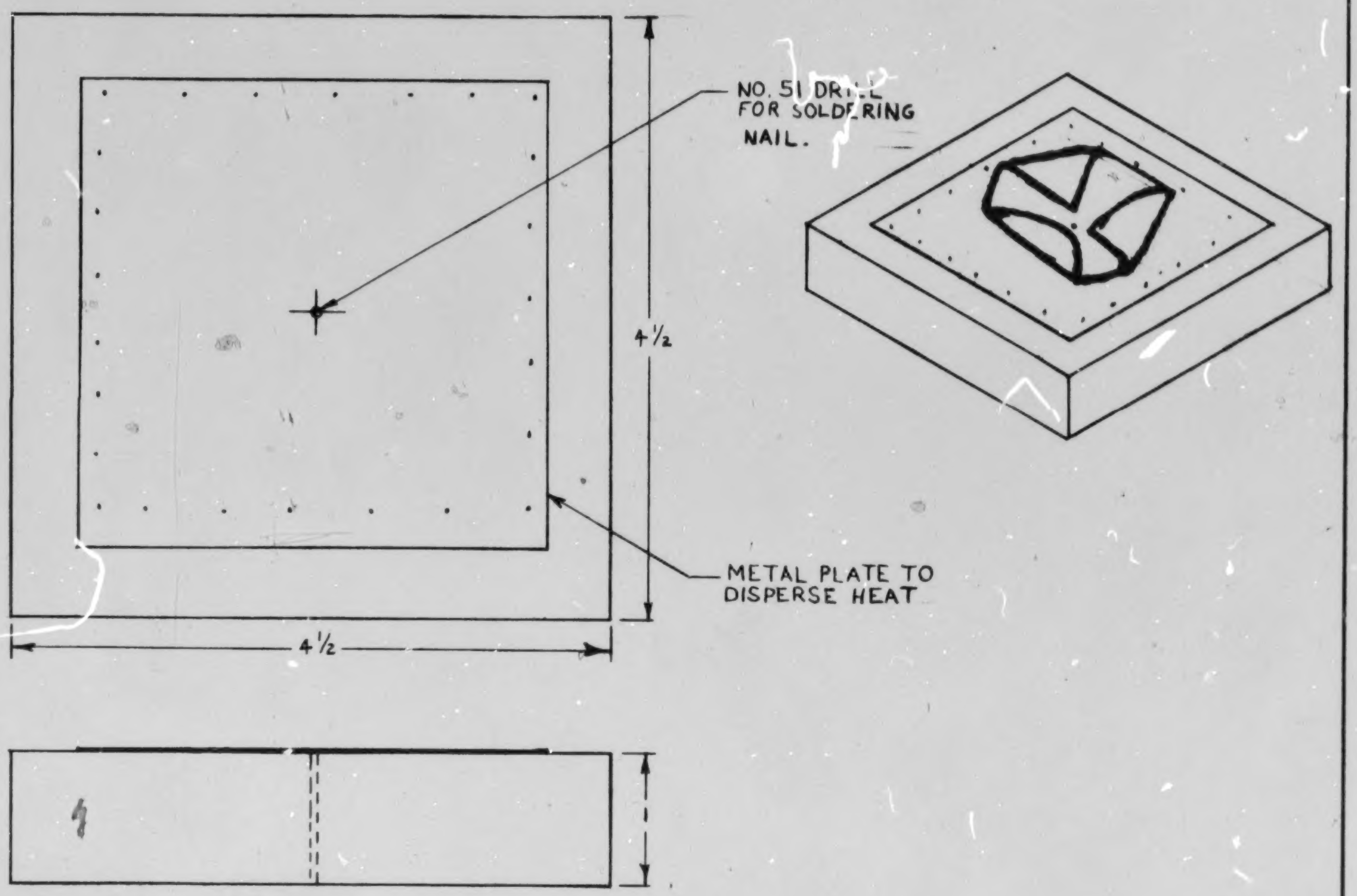
NOTE: CUT DEPTH TO THICKNESS OF TRIANGLE. CUT ONLY ONE PIECE.

DRILL + COUNTERSINK TO YOUR SPEC.
NOTE: DRILL ONLY ONE PIECE

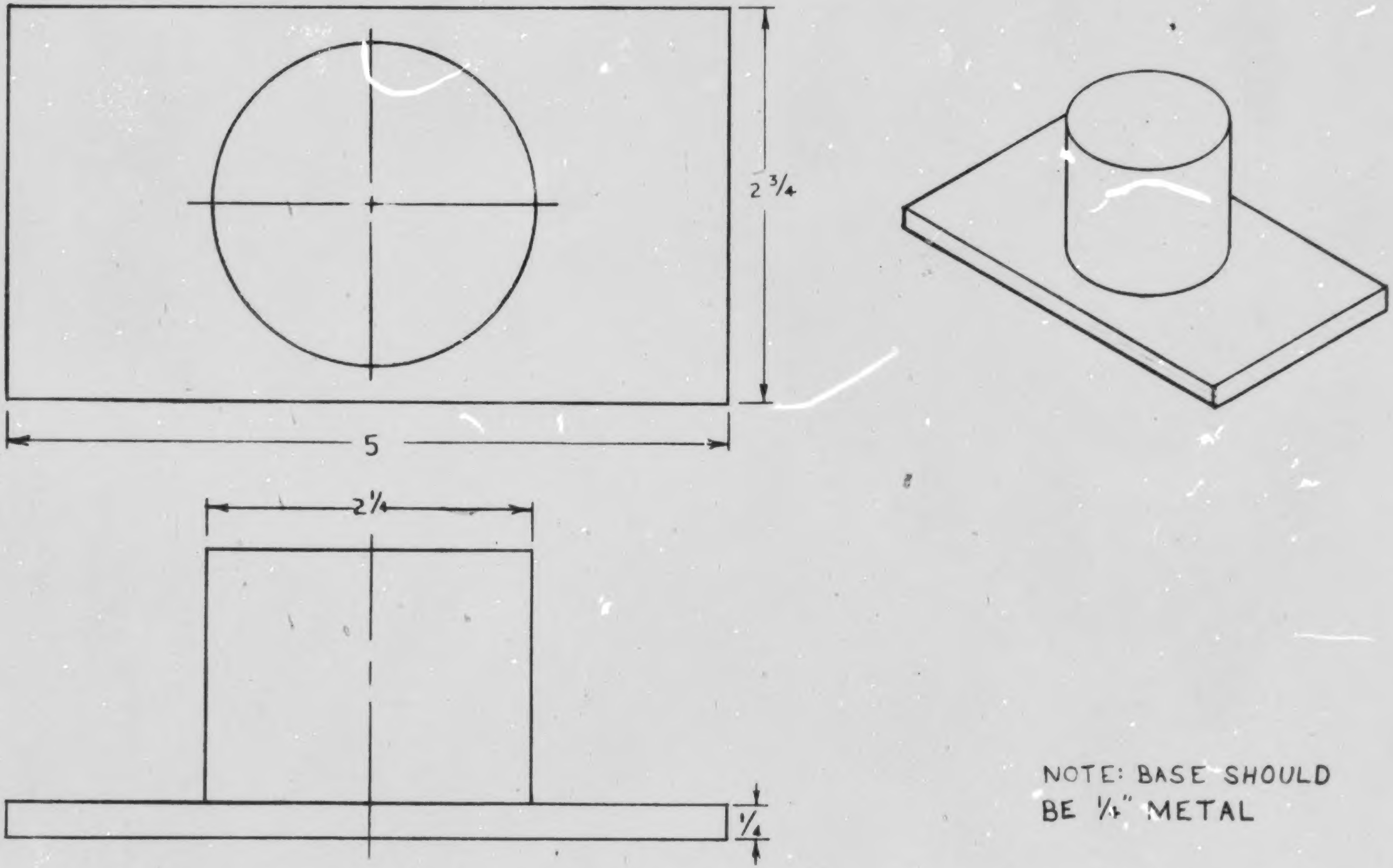
NOTE: MAKE TWO PIECES

ASSY NO.	ASSY NAME		PART NAME BENDING FIXTURE	DATE 1/72	APPR	PART NO.
FIN	MATL MAPLE		STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY M. MAGUIRE		[redacted] PILOT PROGRAM
HT TR	SCALE 1=1			NO.	IA LAB	SECT

F POST CO 175-H 80110


NO. 51 DRILL
FOR SOLDERING
NAIL.
METAL PLATE TO
DISPERSE HEAT
4 1/2
4 1/2

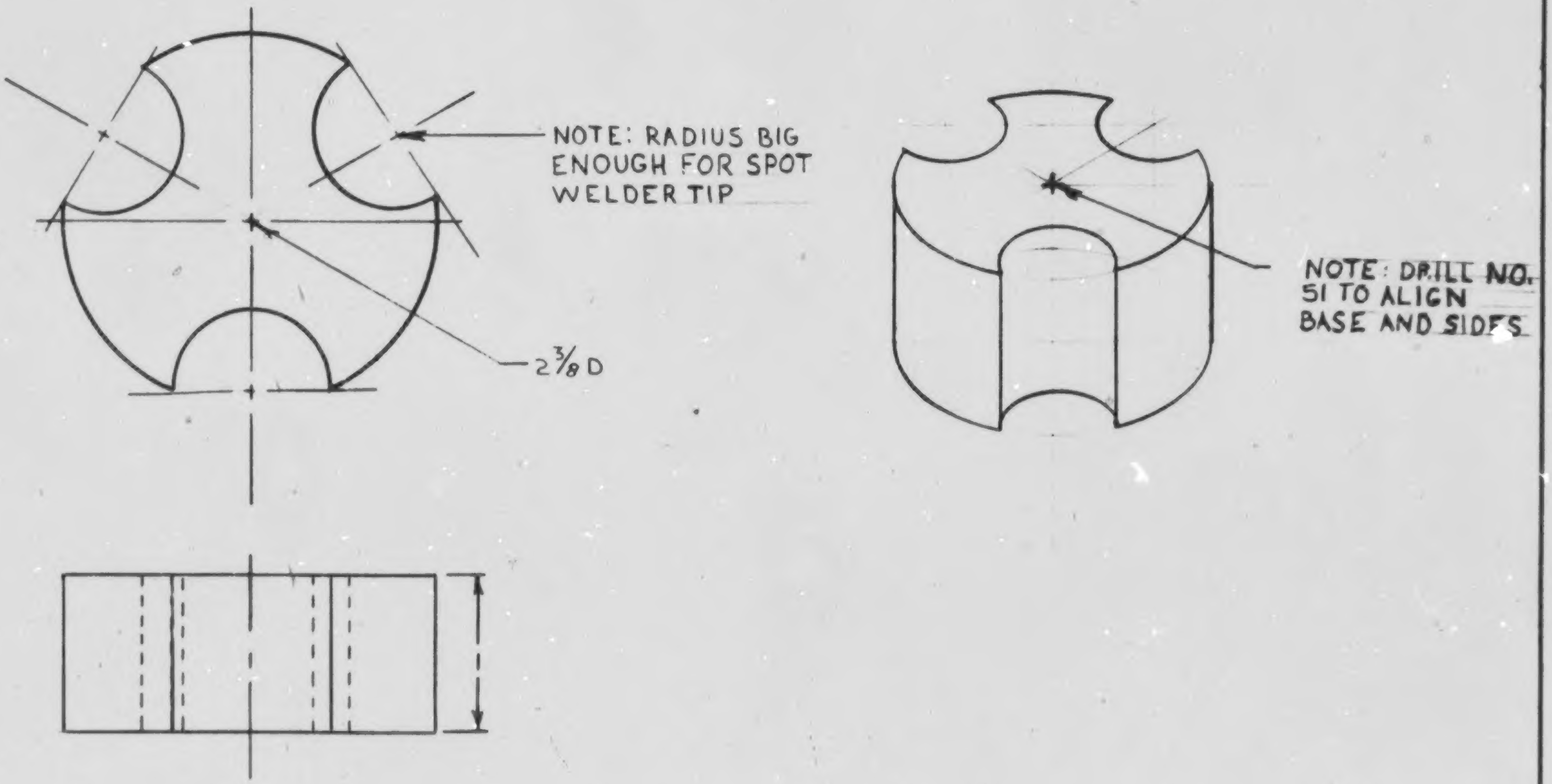
ASSY NO.	ASSY NAME	PART NAME SOLDERING FIXTURE	DATE 1/72	APPR	PART NO.
FIN	MATL WOOD	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY M. MAGUIRE		[redacted] PILOT PROGRAM
HT TR	SCALE 1=1"		NO.	IA LAB	SECT



NOTE: BASE SHOULD
BE 1/4" METAL

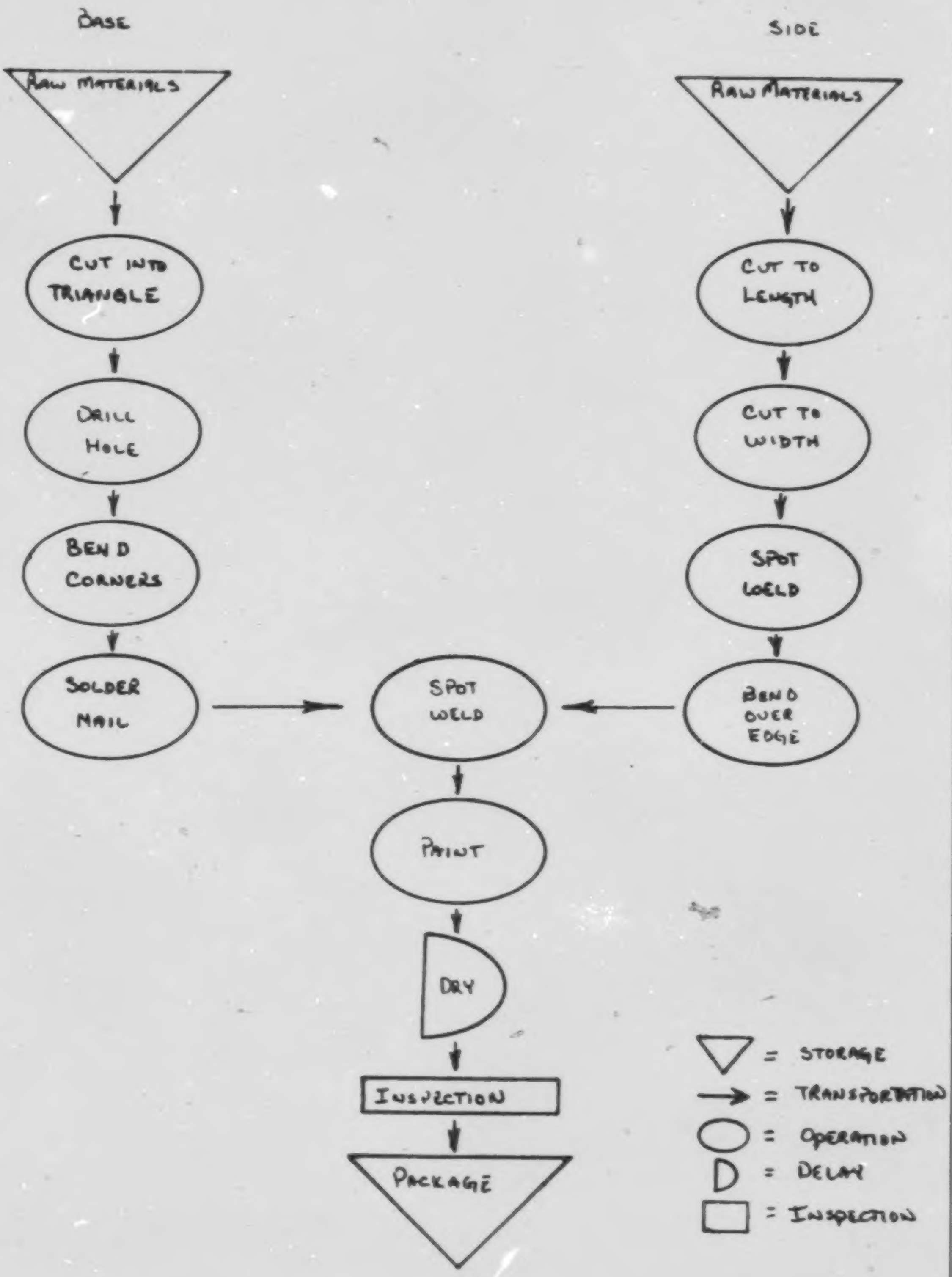
ASSY NO.	ASSY NAME	PART NAME FOLDING FIXTURE	DATE 1/72	APPR	PART NO.
FIN	MATL ALUM.	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK DRAWING AND PLANNING LABORATORY	DWN BY M. MAGUIRE		[redacted] PILOT PROGRAM
HT TR	SCALE 1"=1"		NO.	IA LAB	SECT

F POST CO 175-M 50110


NOTE: RADIUS BIG ENOUGH FOR SPOT WELDER TIP
2 3/8 D
NOTE: DRILL NO. 51 TO ALIGN BASE AND SIDES

ASSY NO.	ASSY NAME	PART NAME SPOT WELDING JIG	DATE 1/72		APPR	PART NO.
FIN	MATL WOOD	STATE UNIVERSITY COLLEGE OSWEGO, NEW YORK	DWN BY M. MAGUIRE			[redacted].
HT TR	SCALE 1:1	DRAWING AND PLANNING LABORATORY	NO.	IA LAB	SECT	PILOT PROGRAM

PROCESS FLOW CHART


BASE
RAW MATERIALS
CUT INTO TRIANGLE
DRILL HOLE
BEND CORNERS
SOLDER NAIL
SIDE
RAW MATERIALS
CUT TO LENGTH
CUT TO WIDTH
SPOT WELD
BEND OVER EDGE
SPOT WELD
PAINT
DRY
INSPECTION
PACKAGE
= STORAGE
= TRANSPORTATION
= OPERATION
= DELAY
= INSPECTION

ASSY NO.
ASSY NAME
PART NAME Process Flow Chart
PART NO. [redacted] PILOT PROGRAM
FIN
MATL
STATE UNIVERSITY COLLEGE
OSWEGO, NEW YORK
DATE 1/25/72
APPR
DWN BY D. LUTZ
HT TR
SCALE
DRAWING AND PLANNING LABORATORY
NO.
IA LAB
SECT

F POST CO 175-H 80110

PART VI

STUDENT GUIDE

D. Bristol
D. Lutz
R. Logan
J. Husted
D. Fidotta
D. McElwain
L. Fletcher
J. Stephani
W. Hutter
M. McGuire

A Comprehensive, informational, instructional guide for

THE IMPLEMENTATION OF MANUFACTURING

in the Public School

Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York,
College at Oswego

your student guide to

TOOLING

jigs and fixtures

Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York
College at Oswego

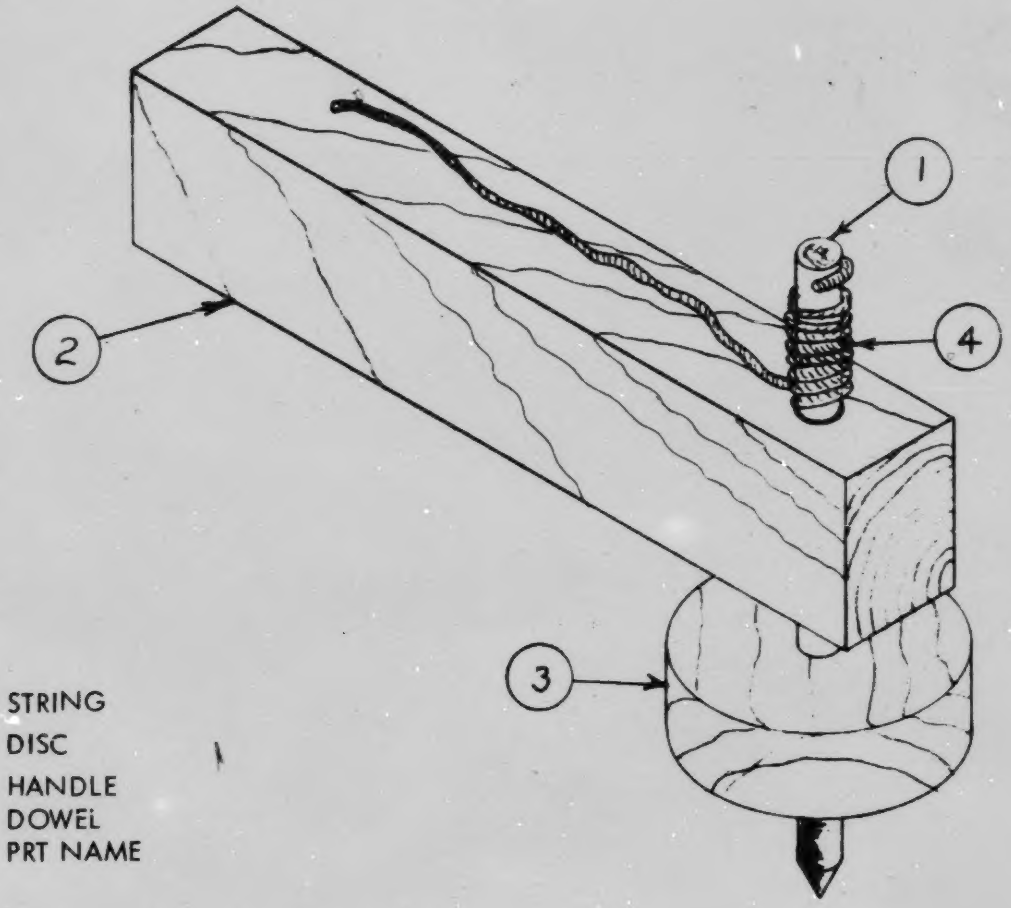
After you've designed a good product your job still isn't over. You still have to figure out a way to make a whole lot of them fast and cheaply. To do this you need to develop a method of mass production. How does mass production work? 1) The parts of the product must be interchangeable. This eliminates the time needed for special fitting. 2) If parts are moved by automatic conveyors, time is also saved. 3) Wasted effort and motion must be avoided. 4) Jobs are specialized (by letting a person do one simple job he can become very efficient at it).

Jigs, Fixtures and Templates

How do we make parts interchangeable, eliminate wasted motion and effort, and at the same time simplify the production jobs? The answer is through the use of jigs, fixtures, and templates. A fixture is any clamping device used to hold a special piece of work and is usually secured to a bench or table. A jig may do what a fixture does, but it must also locate or guide a tool or fastener to the work piece. By doing this the jig eliminates the wasted effort of measuring and holding the work piece. Templates are also used sometimes to eliminate measuring. If you used a jar lid to trace circles on a board, the lid would be the template for the circles.

On the next few pages are examples of jigs used in the manufacture of the handle for the "Spinner Top" mass production project. Perhaps they will give you some ideas in the design of your own jigs and fixtures for your mass production project.

SPINNER TOP



4	STRING
3	DISC
2	HANDLE
1	DOWEL
PRT	PRT NAME

Below is a check list of the purposes or needs that a jig or fixture must meet. Do the jigs shown on the next page meet these requirements? Will the jigs that you make meet them?

Purposes of a Jig:

1._____ eliminates measuring

2._____ makes the job easier

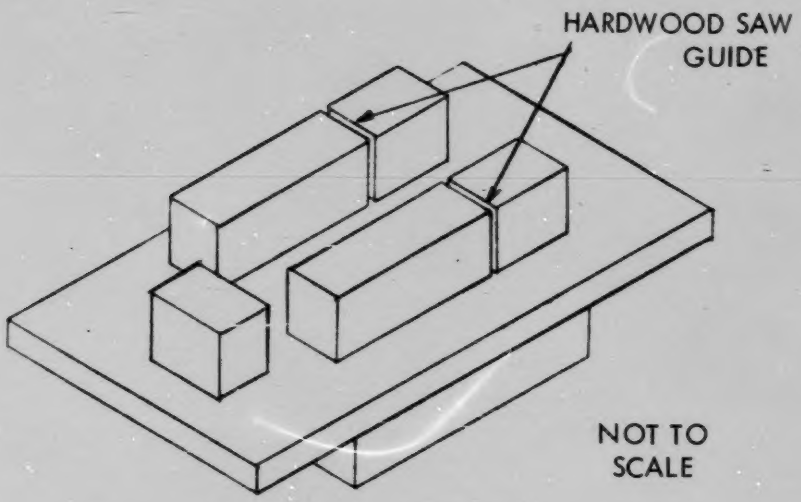
3._____ produces interchangeable parts

4._____ makes the job faster

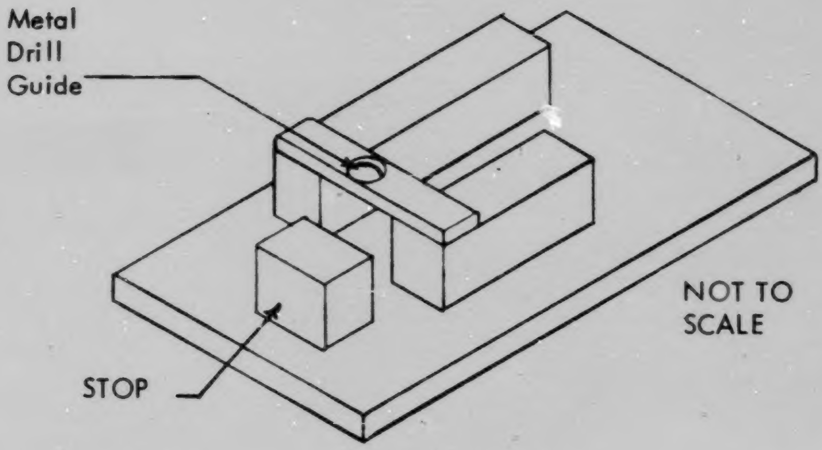
5._____ holds and guides the work piece

6._____ is simple to use

JIG FOR CUTTING HANDLE TO LENGTH


HARDWOOD SAW GUIDE
NOT TO SCALE

JIG FOR DRILLING HOLE IN HANDLE


Metal Drill Guide
STOP
NOT TO SCALE

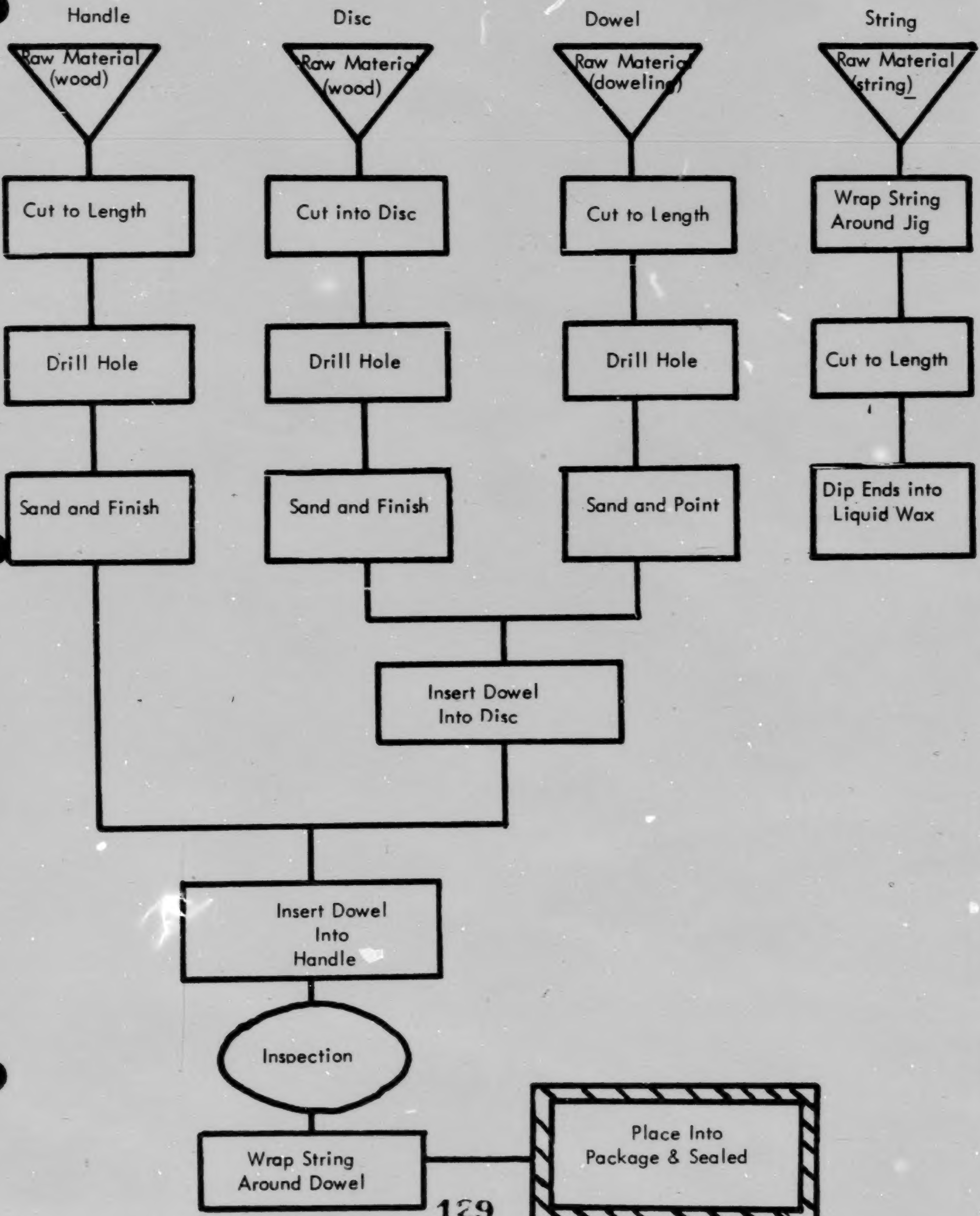
THINGS TO CONSIDER IN DESIGNING A JIG

1.____ Can the work piece be easily placed and removed from the jig?

2.____ Is the jig built strong enough to last?

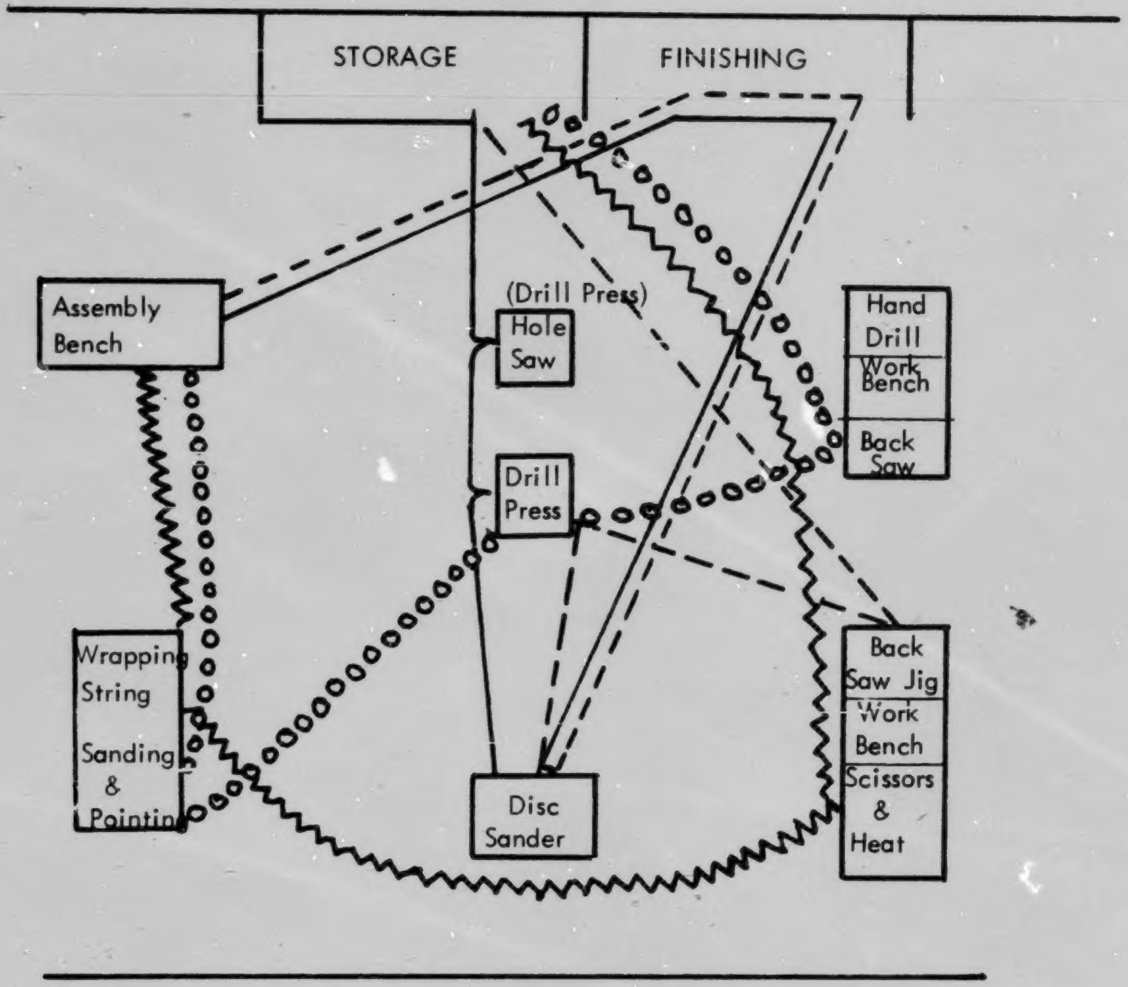
3.____ Does the jig meet the requirements stated on the previous page?

PROCESS FLOW CHART FOR SPINNER TOP


Handle
Disc
Dowel
String
Raw Material (wood)
Raw Material (wood)
Raw Material (doweling)
Raw Material (string)
Cut to Length
Cut into Disc
Cut to Length
Wrap String Around Jig
Drill Hole
Drill Hole
Drill Hole
Cut to Length
Sand and Finish
Sand and Finish
Sand and Point
Dip Ends into Liquid Wax
Insert Dowel Into Disc
Insert Dowel Into Handle
Inspection
Wrap String Around Dowel
Place Into Package & Sealed

ROUTING CHART FOR SPINNER TOP

For: Spinning Top


STORAGE
FINISHING
Assembly Bench
(Drill Press)
Hole Saw
Drill Press
Hand Drill
Work Bench
Back Saw
Wrapping String
Sanding & Pointing
Disc Sander
Back Saw Jig
Work Bench
Scissors & Heat

Key	Symbol
Part #1 (Dowel)	oooooooooo
Part #2 (Handle)	- - - - - - -
Part #3 (Disc)	————————
Part #4 (String)	∧∧∧∧∧∧∧∧

your student guide to

PRODUCTION

producing a product

Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York
College at Oswego

PRODUCTION

Production in a student company is concerned with the fastest and most inexpensive ways of manufacturing the company's product. In order to do this various functions must be performed. This guide is designed so you can understand these duties and will be able to perform these for the company.

One of the first things that you will do for the production department will be to take a complete inventory of all tools and equipment available in your school shop. This could be in a simple list form, showing the type of tool or equipment and the quantity. For example -

TOOLS & EQUIPMENT

ITEM	QUAN.	ITEM	QUAN.
CLAW HAMMER	10	CROSSCUT SAW	6
HAND DRILLS	2	TRI-SQUARES	6
12" RULERS	8	3' RULERS	6

Your inventory form may be entirely different but should serve the some purpose which is to make known all the equipment that can be used for production.

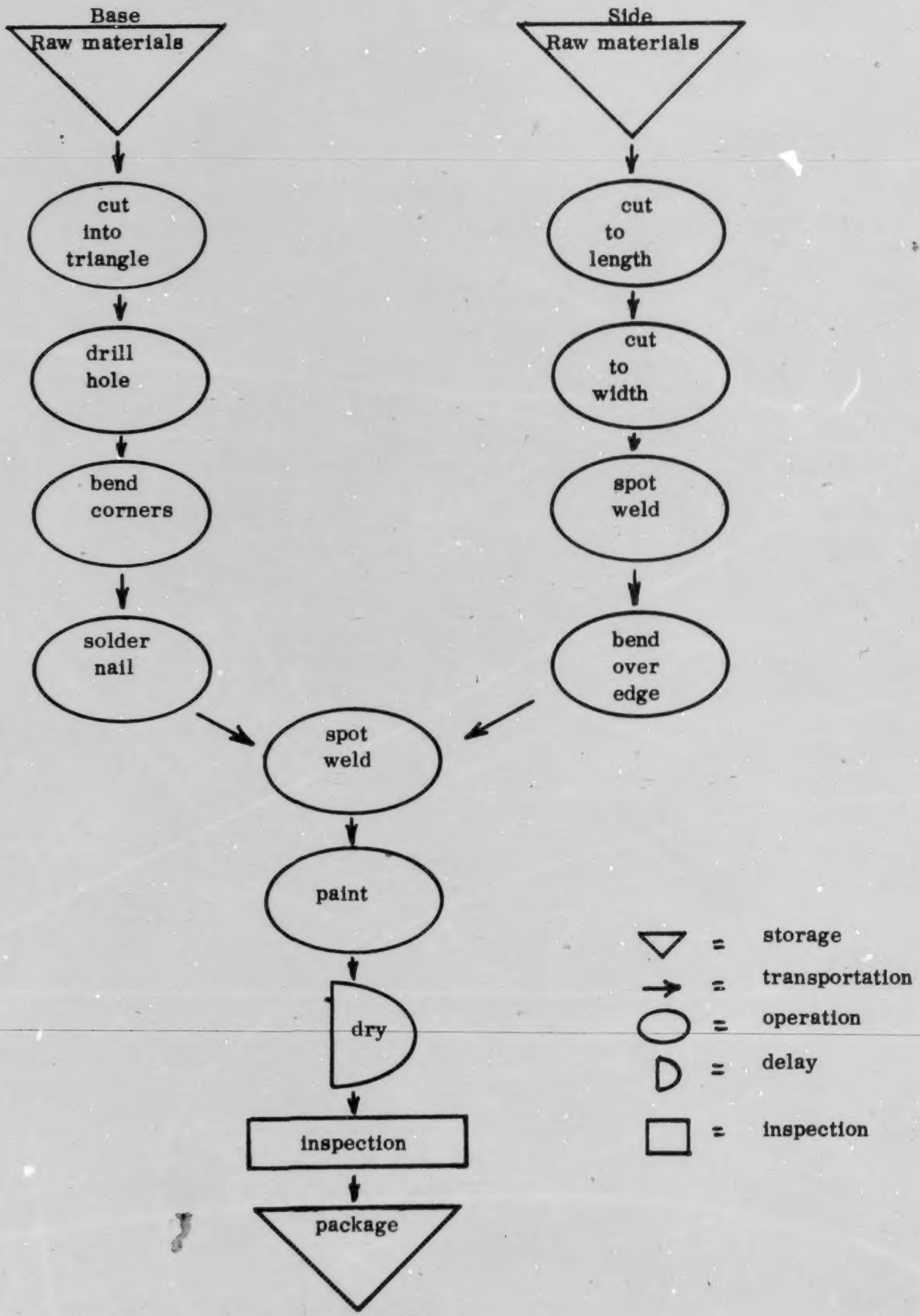
The next thing your department should do is make a scaled down shop layout on graph paper (1/4" = 1" is a good scale) showing the locations of the benches, stock areas, finish areas, electrical outlets, etc. Cutouts then should be made to represent each machine. These can later be arranged to ease in the flow of materials during production.

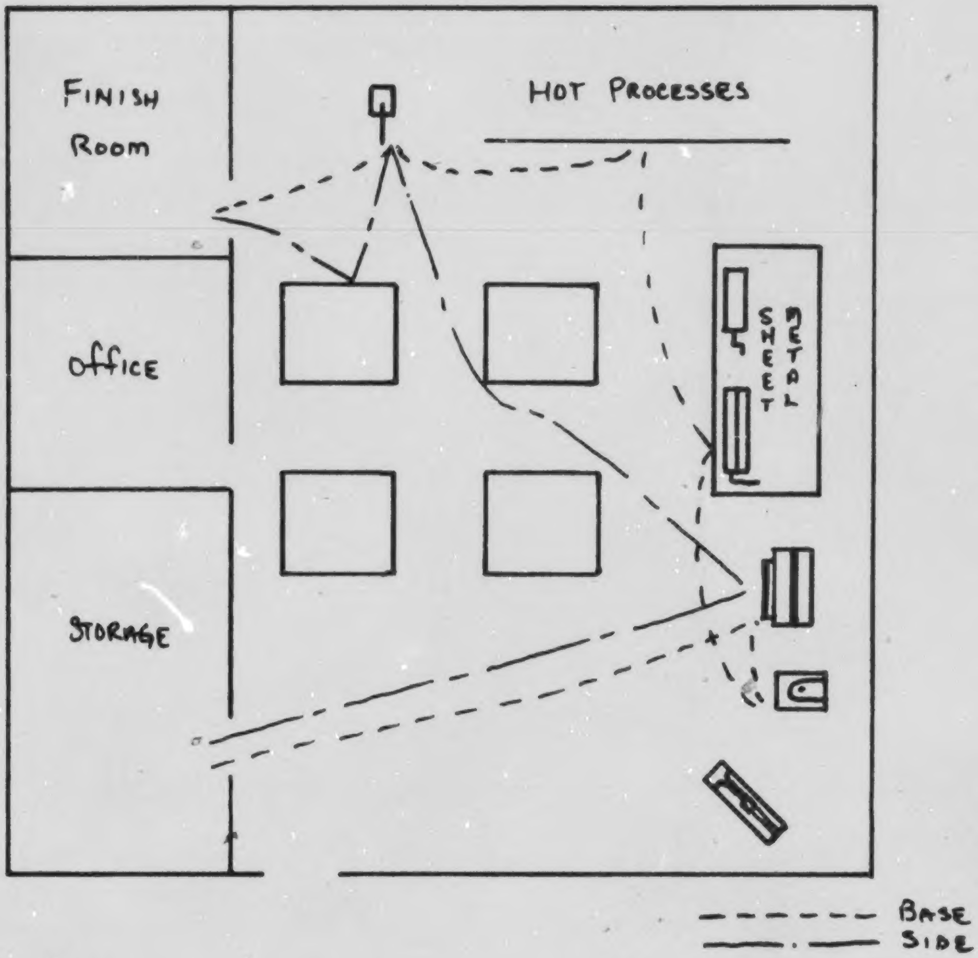
Production and Research and Development will work closely throughout the company. After receiving the working drawings for the product from R & D, your department should next examine the product and drawings to make a "step by step" chart of all operations to be completed in production. The term for this chart is a process flow chart. An easy and understandable way to do this is to use symbols for different happenings within production. For example, storage might be symbolized by a triangle, movement of materials might be shown as an arrow, an operation might be a circle, inspections might be a square, delays might be "D" and so forth. An example of a simple process flow chart is fig. 2 on the next page. Again this is just a sample and the ideas for your chart should be fresh and original.

Once the product is analyzed and the process flow chart is completed, the next duty of your department is to arrange the shop layout on the scaled drawing to ease in the flow of materials in actual production. This routing chart, as it is called can be done in various ways. Again the option is up to you.

One way would be to make one shop layout and to use different types of lines to show the movements of each part's route. Another way should be to make a separate layout for each part and show the part's route by just a simple line of arrows. The first sample is illustrated on the next page.

PROCESS FLOW CHART


Base
Raw materials
Side
Raw materials
cut into triangle
cut to length
drill hole
cut to width
bend corners
spot weld
solder nail
bend over edge
spot weld
paint
dry
inspection
package
= storage
= transportation
= operation
= delay
= inspection



Research and Development and Production will work closely on the jigs and fixtures. After some of these are completed it is smart to make a time study of each operation. This is done to see just how many pieces can be produced in a certain time. Then this information can be analyzed and the number of workers needed to balance the production of the parts can be obtained. A chart can be set up, and is often helpful in arriving at this information. This is up to you but an example would be something like the one on the next page.

The correct name for this chart is a "Production Flow Chart." This chart will help you in forecasting any "Bottlenecks" that might slow production, and also your department will be able to predict just how long production will possibly last.

If the manpower is less than needed a good technique you can use is called stockpiling. In other words, "Blanks" or parts are cut one day and stored until they are needed, This can be done prior to the pilot run and production.

JOB NAME	CUT TO LENGTH	JOINT & CUT TO WIDTH
MIN/JOB	1.5	1.0
MEN/JOB	3	2
JOBS/HR.	120	120

After you have completed all these duties, it is time to start the pilot run. This is a small production run to expose any problems that might occur in the main production run. After the pilot run it is your job to get rid of any problems, which is termed "re-tooling" and then to proceed with the final production run.

One very important part of your department is Quality Control. Q.C. makes sure the quality of the materials, components, and final product is maintained throughout production. Remember -- Quality is built in not added on. This inspection can be accomplished by two methods; random inspection or total output inspection. Either way is effective.

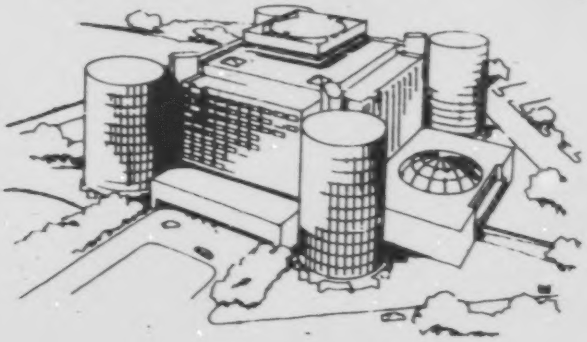
Production is also responsible along with personnel to make sure your fellow workers are efficient and well trained in their respective jobs.

One thing that is a must in your department is organization. Therefore it is best to organize your department completely from the start. Then make sure you maintain that organization throughout the life of your company.

your student guide to

ORGANIZING A COMPANY

manufacturing in industry



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State University of New York
College at Oswego

ORGANIZATION OF A COMPANY

What is Manufacturing?

Manufacturing is a very complex and vast part of today's industry. The basic interpretation of the word, manufacture, is to manipulate a part, to "create", form, or fabricate one substance into a more useful object. Manufacturing began with cavemen, then progressed to the guilded craftsmen of the middle ages, and now the word is usually associated with our present day mass production, which came about during the industrial revolution.

This process of manufacturing can be defined as a change of raw materials to finished products in the most efficient and inexpensive way possible to attain uniformity. Mass production must have uniformity in order to function. For example: the auto industry is not in any one place; some components may be made in Lansing, Michigan, others in Buffalo, New York, yet the entire car will be assembled in Montreal, Canada. This can only be made possible by all parts being produced exactly alike no matter where they are produced. This requires special machines and specialized manpower. Twentieth century craftsmen are known as tool and die makers, they are the producers of the special tooling and machines that can turn out millions of parts that are all exactly alike.

The rest of our labor force today merely consists of a job that has a specific task and that is all that is done, this is called the assembly line. On an auto industry assembly line one person may put in two bolts, the next person will put on the washers and still a third person will put the nuts on and secure it, this is the only contact they have with making a car. It is a very tiring task for individuals, however, in the past few years automation has taken over. Automation is the replacement of a human being on an assembly line, with a machine that can perform the task equally as well as any person. In a student company there will be an assembly hire, however, very little automation will be used, mostly it will be student assembly work.

* For further explanation see the Student Guide/Self Study Module on tooling.

WHY STUDY MANUFACTURING?

In many ways the United States is an unusual and favorable country. We have at our disposal vast supplies of natural resources and highly productive soil. We have converted these resources into a standard of living that is the envy of the rest of the world. We take our luxurious homes, swift transportation systems, gigantic shopping centers, and unlimited out pouring of consumer products for granted. What has brought our country so far in its short history?

We have produced, in our country, a system of industrial manufacturing that is the foundation of our "American Way of Living." It is safe to assume that some day you will be part of this system as owner of your own business, an engineer, a laborer, or at least a consumer. Effects of our rapid and extensive industrialization have not all been good ones. We are beginning to realize that pollution and industrial waste can not be ignored. How can we ignore a segment of our lives that has such powerful effects on our lives?

INDUSTRY IS SO BIG. MANUFACTURING IS SO COMPLICATED. HOW DO YOU BEGIN?

A Company Grows

The scene opens in an office.........

WARD: I'm Gary Ward, the owner of the Ward Slugger Company. When I was still in high school, I enrolled in a vocational wood working course. I gained an interest in the production of wood products, and decided that I would like to do something like that for a living. After high school graduation, I attended a community college and took business management. At the same time I went to work for a local furniture factory. While I was working in this factory I decided that I might start my own manufacturing business. So, with a small loan and some money I had saved, I purchased the equipment needed to produce a new baseball bat. I leased a small building where my business could be conducted. Last week an old friend, John O'Conner, came into my office.......

O'CONNER: Gary, I have $20,000 I would like to invest in a company like yours. I know you have a successful enterprise, but if you combine your company with my money, together we could expand the manufacturing and sale of sporting goods.

WARD: I thought about Mr. O'Conner's offer and decided to accept it. I enjoy the freedom of a sole proprietorship and the satisfaction, but I would like to bring out some new products and I don't have the capital.

NARRATOR: So, Mr. Ward and Mr. O'Conner combined their capital and became "partners" in the American Sporting Goods Company. With more money they were able to buy land and build their own manufacturing plant. They were also able to open a retail store in their city where part of their production could be sold. Mr. Ward and Mr. O'Conner found that their combined management skills made the enterprise more efficient. The work load was divided by having Mr. Ward take over Production and Mr. O'Conner handle sales and distribution of the products. Three years later we find the two partners talking..........

O'CONNER: Well Gary, we have been partners for three years now. Business has been good and I know we have good products because they sell well. I was wondering if we had a larger marketing area could we make a larger profit?

WARD: I agree, of course to reach more markets we would have to build a larger plant. Also we would have to open more retail outlets.

O'CONNER: We could sell through department and discount stores.

WARD: Yes, but we would still have to raise a great deal of capital just to build a larger plant and warehouse. How do we get financing?

O'CONNER: How about making our company a corporation?

WARD: If we divided the company into 200,000 shares and keep 51% of them to maintain control, we could sell the remainder at a par value of $10 a share. That would raise $900,000 for expansion.

O'CONNER: I'll have our lawyers draw up a charter as soon as possible.

WHAT IS A CORPORATION CHARTER?

To form a corporation an application to do business, called Articles of Incorporation, must be submitted to a state commission that regulates corporations. These organizations grant a Charter to sell stock and conduct business in their state. On the next page you will find such an application for your company. Since your company will not be Legally a corporation you will apply to your school not the state.

The By-laws on the following pages are the rules a corporation uses to conduct its business. You will need most of the articles included and shouldplan to adopt them. Your company may wish to amend them to suit your needs.

ARTICLES OF INCORPORATION

Executed by the undersigned for the purpose of forming a non-legal corporation.

Article 1. The name of the corporation shall be:

____

Article 2. The period of existance shall be:

____

Article 3. The purpose shall be to conduct business for profit in the city of

__________________ state ______________ school __________

Article 4. The number of shares of stock and par value shall be:

Article 5. The address of said company:

Universal Company
Room 11
Reluctant Junior High
Gotham City, Idaho

Article 6. The board of directors shall consist of the entire class.

Article 7. The names of the officers shall be:

President ______________________
V.P. Finance ______________________
V. P. Engineering ______________________
V.P. Marketing ______________________
V.P. Personnel ______________________
V.P. Production ______________________
Corporate Secretary ______________________
Treasurer ______________________

Article 8. Other provisions of this company not previously mentioned.

Executed in duplicate on the __________ in the office of the

Principal, Reluctant Junior High ________________________

Corporate By-Laws

ARTICLE I NAME AND MEMBERSHIP

1. The name of this company shall be the Universal Company
2. Membership of the company shall be limited to members of class of room 11 and membership shall terminate upon leaving said class.

ARTICLE II THE STOCKHOLDERS

1. This company is owned by the stockholders, who by endorsement of his stock certificate appoints the class proxy to vote in all meetings.

2. Meetings of the stockholders may be called by resolution of the Board of Directors. Written notice of time, place and written agenda shall be delivered to each stockholder not less than five days before such a meeting.

ARTICLE III BOARD OF DIRECTORS

1. Control of the companies business and affairs shall be vested in a Board of Directors consisting of the membership of the class.

2. Regular meetings of the Board of Directors shall be held every second week. Special meetings may be called by the President or petition of three directors. All meetings must take place during regular class time.

3. A quorum at any meeting of the Board of Directors shall consist of at least half of the Board.

4. The order of business at a Board of Directors meeting shall be:
    1. Call to Order
    2. Department reports
    3. Old business
    4. New business
    5. Adjourn

5. The duties of the Board of Directors shall include but not be limited to: Election and removal of company officers, protect stockholder's investment money, determine produc selection, establish divident payments.

ARTICLE IV OFFICERS

1. Officers of the company shall be approved by the Board of Directors.

2. Nominations for office shall be by a committee of three directors and the teacher.

3. Officers shall be:
    - President
    - Vice President for
        - Engineering
        - Personnel
        - Finance
        - Marketing
        - Production
    - Corporate Secretary
    - Treasurer

4. Regular officers may be removed from office by a two-thirds vote of the Board of Directors.

ARTICLE V DUTIES OF THE OFFICERS

1. PRESIDENT He shall be the chief executive officer. He shall preside at all meetings, and have the authority to sign all official documents. He shall report directly to the Board of Directors.

2. VICE PRESIDENT OF ENGINEERING He shall plan, prepare and oversee the engineering program of his company. He shall develop drawings and specifications for products, institute product testing, develop and build jigs and fixtures required for production and develop and implement quality control. He shall report to the President and the Board of Directors.

3. VICE PRESIDENT OF FINANCE He shall plan, prepare, and oversee the financial program of the company. He shall have final approval of all purchase orders. He shall report the the President and the Board of Directors.

4. VICE PRESIDENT OF MARKETING He shall plan, prepare, and oversee the marketing program of the company. He shall be the Chief Sales Officer, training, assigning, and supervising all salesmen. He shall be responsible for market research, advertising, packaging, and distribution. He shall report to the President and the Board of Directors.

5. VICE PRESIDENT OF PERSONNEL He shall plan, prepare, and oversee the employee personnel program of the company. He shall be the chief personnel manager, finding, interviewing, training, and assigning all workers. He is responsible for administering questionnaires, tests and ratings to all personnel as well as keeping employee records. He is the chief company negotiator in labor disputes and agreements. He shall be responsible for planning, preparing, and overseeing the safety program for the company. He shall report to the President and the Board of Directors.

6. VICE PRESIDENT OF PRODUCTION He shall plan, prepare, and oversee the production program of the company. He shall supervise all production work and clean up of plant facilities. He shall also be responsible for maintainence of tools and equipment, production schedules, and requisition of tools and raw materials. He shall report to the President and the Board of Directors.

7. CORPORATE SECRETARY He shall keep official minutes of Board meetings, carry on company correspondence, and issue notices of meetings. He shall maintain Official company files and records. He shall report to the Vice President of Personnel.

8. TREASURER He shall have custody of all monies of the company. He shall maintain a checking account, and shall have the authority to write and sign checks. He shall keep records as required by Finance and the Board of Directors. He shall report directly to the Vice president of Finance. In cases of school policy the Teacher may be elected to this office.

ARTICLE VI COMPENSATION

1. The board of directors shall determine all wages, salaries, or commisions, and other compensation to be paid.

ARTICLE VII TERMINATION

1. This company is organized for the school term only.

2. The company can be dissolved by a two-thirds vote of the Board of Directors, at a special meeting called to consider termination activities.

ARTICLE VIII AMENDMENTS

1. These by-laws may be amended by a three-fourths vote of the Board of Directors at any regular meeting.

Adopted by the Board of Directors of the ______________________________

on the ________________________

____
President

____
Corporate Secretary

LEASE

PARTIES:	This LEASE, made and entered into this third day of October, 1984, by and between Jan's Junior High, hereinafter called the LESSOR, and Universal Company, hereinafter called the LESSEE;
PREMISES & USE: TERM & MONTHLY RENTAL:	WITNESSETH, That the Lessor, in consideration of the educational purposes of Universal Company and of the rents and agreements hereinafter mentioned, has leased to said Lessee the workspace designated as Room 11, Jan's Junior High, at Melrose Park, Gotham City, Idaho, to have and hold same for the purpose of carrying on their company industry between the hours of 9:03 a.m. and 9:47 a.m. on Monday thru Friday of each week commencing November, 1984, for the sum of $1.00 per month, payable on or before the first of each month. This agreement shall end upon termination of the Lessee's business.
CONDITIONS:	The Lessor agrees to furnish electricity and heat for the workspace. The Lessee agrees to keep the workspace clean and in good order.
FURNITURE & FIXTURES:	The Lessor further agrees to provide for the use of the Lessee lockers, chairs, tables, and workbenches at a semester charge of $1.00.
EQUIPMENT & MACHINERY SEMESTER RENTAL:	The Lessor to provide also equipment and machinery already in Room 11 at a semester charge of $1.00. Materials used will be paid for on a pay as you use basis and will not be restricted to the Lessor's material.

Which furnishings and equipment the Lessee agrees to use properly and with reasonable care, and for which the Lessee agrees to pay to the Lessor, upon receipt of invoice, total rental and charges specified above.

IN WITNESS WHEREOF, the said parties have executed this Lease, in duplicate, on the day and year aforesaid.

For Universal Company, Lessee

____
President

____
Corporate Secretary

For Jan's Junior High, Lessor

____

Types of Industrial Organization

Even though your class will probably form a corporation, there are other types of industrial organizations (ownership) that you should be aware of.

The following are three different types of ownership:

1. Proprietorship - one man is the owner.

   Advantages:
   1) He has complete control, gains all profits, and can dissolve the company at any time.

   Disadvantages:
   1) He is liable for all aspects of the company.
   2) His personal property may be taken away from him.

2. Partnership - two or more people are owners

   Advantages:
   1) More ideas and capital available.
   2) Less responsibility on each owner.

   Disadvantages:
   1) Owners have to share profits.
   2) Possible loss of personal property.

3. Corporation - many owners

   Advantages:
   1) Large amounts of capital available.
   2) Shares of ownership can easily be given or sold to other people.
   3) Owners cannot be made to pay for all of company debts.

HOW TO ORGANIZE YOUR COMPANY

From class work, films, and your own reading you have seen that a corporation has a way of organizing the effort of its workers to get the most work finished. You have seen that there are separate departments each with responsibilities for getting the job done. Let's take a look at the management level of this organization and see how you can use it.

The stockholders are the owners of the company. They elect the board of directors who are charged with running the company and protecting the investment money of the stockholders. This election is usually held at the annual stockholders meeting. Stockholders in your company will surrender this vote by proxy and agree that the entire class will be the board of directors.

The president and the five vice presidents of departments make up what is called the executive committee. These men are hired by the board of directors on the basis of job applications and interviews. Many methods from letting the teacher pick them to a direct election could fill these positions. You can see though that the first order of business for the "board" is to fill these key positions with the best qualified men you can choose.

Once you have filled the executive committee the corporate structure can begin to function. Most of the decision making will take place in the meetings of the executive committee. These men will meet whenever necessary and especially before a board of directors meeting.

Try to remember a meeting you were part of that ran smoothly and where a great deal was accomplished. Was there a plan? Chances are there was and in a board meeting it will be even more important to have an agenda (formal meeting plan). Article III of the by-laws has a list of topics that should be covered and on the next page is an example of an agenda that could be used for your first meeting.

As President of the company you have the overall responsibility for the supervision of the company's departments. You must be aware of their operations and organization to make sure they are running smoothly. You must be prepared to guide and assist them anyway they might need.

Your direct responsibilities are:

1. Report to the Board of Directors and Stockholders.
2. Call and lead all Executive and Board of Directors meetings.
3. Have general supervisory control over the company programs and policies.
4. Appoint or select people to serve in different management positions.
5. Sign all official documents and checks of the company.

So in summary; it is your responsibility to keep the company organized and running smoothly.

GENERAL BOARD MEETING AGENDA

I. CALL TO ORDER

President

A. Vice-President of Personnel records attendance.
B. Secretary reads Minutes of last meeting. Vote approval.

II. REPORTS

A. President-General condition of the company.
B. Vice-Presidents report on their departments.
C. Either Vice-President of Finance or Treasurer gives a treasurer's report.

III. OLD BUSINESS

Subjects presented to the Board previously on which action has not yet been completed. The individual concerned describes current status of the subject and makes a recommendation for action.

IV. NEW BUSINESS

A. Subjects not previously considered which require action by the Board. The President asks for any such subjects as they may have come up since the last Board meeting.
B. If study is required, he refers the subject to the responsible person for report at the next meeting. If action can be taken now he asks for an appropriate motion.

V. DISCUSSION TOPIC

This is a slot for guest speakers or the instructor to present material on improving the business if anything.

VI. ADJOURN

Motion to adjourn is called for by the President, made, seconded, and voted upon. There is usually no problem getting a majority of ayes.

Taken from Student Guide to Manufacturing, prepared by Jan Hallenbeck and Gary Ward (student teachers)

Department of Industrial Arts and Technology
State University College
Oswego, New York 1970-71 pp. 1-9

your student guide to

RESEARCH AND DEVELOPMENT

building a better product

Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York
College at Oswego

SO NOW YOU HAVE A COMPANY....................WHAT DO YOU MAKE? *

I know; you have thought and thought but can't come up with a product. If it makes you feel better, you are not alone. In the history of the world there have been very few original thinkers. Well, where do the ideas come from?

We think of television as a new invention. Would you be surprised if I told you that the Greeks knew about electricity as early as 600 BC? We certainly would not have any electrical invention without such knowledge. Alexander Volta discovered a way to generate electricity with a device called a battery. In 1820 Orested, a Dane, proved electricity could produce magnetism. It took Samuel Morse to put this all together and invent the telegraph. Slowly but surely one man's ideas are built on the next to create products like television.

How can we make use of this in trying to design our product? Industry has the same need you have for good new ideas and they want them fast. Computors help in analyzing facts but they can not create. Is there a system of thinking and creativity? Sorry, there isn't. Good thinking takes practice, just like being a good football player. There is a system called brain storming which helps get thinking out into the open.

BRAIN STORMING

One person's ideas suggest ideas to someone else. If someone is critical of an idea of yours, you clam up, right? These suggest the two rules of brainstorming.

Gather a group of people around in an informal circle. Appoint one person to take down ideas (they get forgotten, right?). Start off the session by listing the problem. Every idea is OK no matter how ridiculous (it could suggest something to another). Do Not criticize or evaluate. If ideas stop, try reading the list out to the group. When all ideas have been gathered, as a group; discuss the good and bad features. You may start over on one promising idea and try to expand it.

* Student Guide, Fall 1970

PROBLEM/GRIPE/NEED METHOD

- anything that annoys you or somebody else is put on the list -

ex.:

Problem: Your pens and pencils are always laying all over your desk, your books are hard to carry, you always forget to bring a pencil to class.

Solution: You design a pen and pencil holder, or a carrying strap, or a pen holder that attaches to your notebook.

SOURCES FOR IDEAS

- For an idea to be original doesn't mean you can't re-design or improve an existing idea. Many times people are dissatisfied with a product and if asked, will give you many suggestions for new improved versions.
- Magazines, catalogs, and other printed materials, contain pictures of things that interest people. Home magazines, Popular Science, and other magazines have new product sections in them. A walk as a group of three or four, in a shopping center, might also suggest several new product ideas.

PRODUCT LIMITATIONS

- Whatever you decide to produce you will have to consider some fixed requirements. These are called product limitations. Use this list as a guide when designing your product.

1._____ Are the other members of the class interested in this product?

2._____ Does the product answer a specific need?

3._____ Can it be made with the tools and equipment in your shop?

4._____ Are there parts that can't be made?

5._____ Can these be bought?

6._____ Can it be massed produced?

7._____ Is there a market for the product?

So you are interested in the research and development area of your company. This part of your student guide is to help you better understand just what your job will be. To begin with your class should have all ready decided on a product to make. This could have been done through any of the methods of product generation described on the previous pages.

Drawings: To begin with you will have to make a pictorial drawing of your product. This drawing should include a list of the materials that will be used to make the product as well as the dimensions of the product. A work list with a space for a drawing is provided on the page following this information.

Modeling: You still aren't ready to produce your product. A model (anything built to look like the product, but may be made of a different material and not necessarily true to size) will give you and your company a still better idea of what you are making. The model should be quick and easy to make (materials like clay and paper are good to use).

Prototypes: A prototype is a full scale working model that is exactly the same as the finished product will be. This may take a lot more time to make than the model because the materials used are the same as those of the finished product, but the prototype is usually made by hand. I suppose you are wondering why you need a prototype anyway? Well, for one thing, when making the prototype you will actually use some of the processes (cutting, drilling, etc.) that you use when you mass produce the product. This helps you think of ways to make the product faster and better. You can

continued...

also use the prototype to show what you are making to other people so that you may get their opinion on whether or not they would buy one.

Testing: Now that you have a prototype you can test it to see if your product is safe, strong, and workable. If it does not meet all the needs that it was designed for now is the time to improve it, not after you have produced them all. When you hear of a product being called off the market or being called back to the factory for repairs (like some cars are) it is usually because of poor design causing part failure. Many other products that you use are poorly designed but still sold. Flashlights, radios, etc. that don't work well are always being sold to people who think they are saving money by buying products that are inexpensive. They are usually cheaply made. Make sure you design a good product.

RESEARCH AND DEVELOPMENT

(Work Sheet)

1. Product Title:

2. What needs does the product meet?

3. Pictorial drawing:

4. Dimensions:

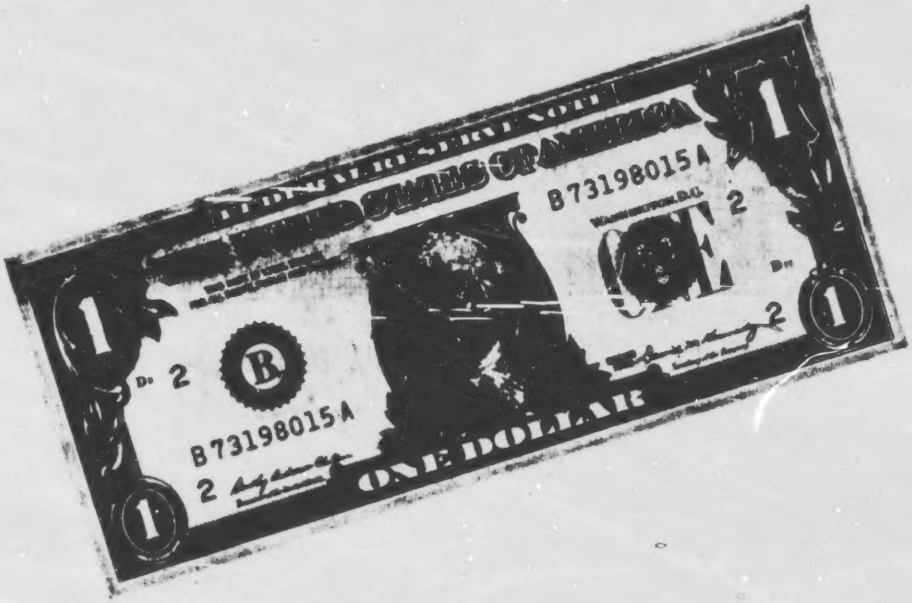
5. Materials Used:

6. Production or Tooling processes involved:

your student guide to

FINANCE AND CONTROL

money in the company


FEDERAL RESERVE NOTE
THE UNITED STATES OF AMERICA
B73198015A
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ONE DOLLAR
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B

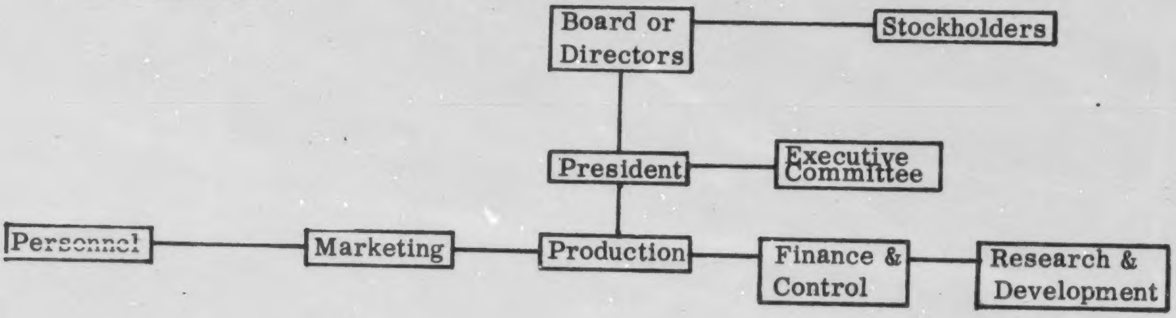
Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York
College at Oswego

What Will The Finance Department Do?

During the time that your department will function, you will be responsible for raising money by the sale of stock, keeping track of money, materials and purchases, estimating product and operation costs, and determining the profit or loss of the company.

Finance and Control (F & C), along with Personnel administration, Research and Development, Production, and Marketing is a functional area common to all manufacturing concerns. Each area is interdependent upon one another. The head of F & C is a member of the executive committee (refer to chart A below) which advises the president on financial matters. The executive committee is extremely important to uniting the efforts of the company organization. Your role as head of F & C is very influential on this committee.

BASIC ORGANIZATIONAL STRUCTURE OF A TYPICAL MANUFACTURING ENTERPRISE



Pre - Budget Chart

Prior to development of your prototypes in Research and Development, the entire class will be involved with the construction of simple models. These models are nothing more than ideas of various groups as to what product would sell best and what it would look like. The construction of these models will require the acquisition of certain materials. Finance and Control must record these costs and pay back those who have made the purchases. Below is a sample pre-budget form. Again you should consider designing your own form as it will be more meaningful to you and will be more useful to uour own company. See chart on next page.

Pre-organizational R&D expenses (pre-budget)

Product development team weekly calendar

item description	price	purchaser	supplier	approval	receipt attached	Repay at capitalization	Apply loan to stock purchase	other (describe)
Spiral binders	$ .30	French	Bookstore	tu	x		x	
Construction paper	$ .05	Michael	Bookstore	tu	x	x		
Fiberboard	$ .10	Lab	Lab					x end of course

You will notice that each person has a choice as to how he wants to be repayed. Mr. French wants his 30¢ to go towards stock purchases. Mr. Jones would like his 5¢ back at initial capitalization (time when stock is first sold to gain money).

The purchased items must be approved before the terms are met. A possible option to this would be to have automatic approval for items costing less than $1. The receipts are the proof of purchase that should be stapled to the pre-budget form. In this example the lab was content to receive any payments due at the end of the course. This would be called a credit but remember - it must be paid back. Also note that you should have 3 or 4 or more of these forms depending on the number of model development committees you have. The name of each committee should be written on the top of the form.

Stocks

One of the first items to be considered by the Finance and Control department is raising capital to begin financing materials that are sure to be needed.

What are some of the sources of capital that industry makes use of? One of the major sources comes from savings. Basically any capital comes from savings. A second source comes from loans. Loans may come from personal friends, relatives, and lending institutions. A friend of yours may loan your company $5 at 10% interest and at the end of 1 month, for example, he would receive $5.50. A third source, the sale of securities, namely stocks, would be the method you will want to consider at this phase of your organization. Industry makes use of two forms of stock called common and preferred. If you own 3 shares of common stock and it pays $3 per share, you would always get back $9, (3 shares x $3 per share) unless, of course, the company enters bankruptcy (bankruptcy will be discussed later). Preferred stock is somewhat different, possible more of a gamble. As was stated, common stock always yields a fixed profit return. After the common stock profit returns have been distributed, the profit remaining is given to preferred stockholders. If there was $300 remaining and there were 10 preferred stockholders, each having 30 shares to his name, each share would be worth $1.00 ($300 profit remaining ÷(10 stockholders x 30 shares or 300 shares)), therefore each man would be given $30 in stock returns. If the profit remaining is greater than $300, it is easily seen that each man would yield a larger return; but, on the other hand, if the profit is less than $300, his return would be smaller. One more word on this topic is that you must realize that the preferred stock may cost you a great deal more to buy than the common. As you have learned earlier, if you have the gambling bug, you may choose to buy preferred stock; if you enjoy the comfort of t nearly sure thing (dependent upon the company's financial state) you will probably purchase the common stock.

At this point you should refer to the Sample Stock Form (B) on the next page. You and your assistant will want to design a stock certificate that will suet your needs. This example is simply a means of acquainting you with certain basic parts of a stock certificate.

Once you have your stock certificate, you must decide on the value per share of stock and possibly limit the number that can be bought. Any stocks not sold may be auctioned at your Board of Directors (entire class) meeting.

Industrial concerns usually print up a booklet called a prospectus that tells potential stockholders about their company - i.e. what the company is, what it makes, and why they think it is a good investment. If you and your assistant are real Gung-Ho, you may consider this idea.

How Are Prices Determined?

You may have noticed that the costs are shaped by the company's efficiency and the selling price is shaped by competition and market. The customer is the REAL BOSS: What the customer is willing to pay for a service or product is the final determining factor. In a free economy, where competition is encouraged and a freedom of choice for the customer exists, no "artificial" price can long service. Keep in mind - consumers do not always buy by price alone, QUALITY also plays a big role.

Every business must make a PROFIT.

STOCK CERTIFICATE

Shares

Serial Number

THIS CERTIFIES THAT

FIRST NAME LAST NAME STREET

CITY STATE ZIP

is the owner of ___ share(s), par value ______, of capital stock in

Date Treasurer Stockholder

The Stockholder by signature votes class to Board of Directors

ACOUNTING RECORD

Date ________

Stockholder ____________________ Number of Shares __________

Street ____________________ Money Recieved ___________

City ____________ State ________ Zip ____ Payment Cash ____ Check ____ Other ____

Taken from Student Guide to Manufacturing Fall 1971 Pilot Program

HOW COSTS ARE FIGURED

THIS IS WHAT GOES INTO FIGURING THE SELLING PRICE

	cost per unit
1. No. of units	
2. Raw materials	
Wages	
TOTAL PER UNIT	
3. Facilities and machinery	
Shop supply	
Depreciation	
Salaries	
Packaging and promotion	
Administrative	
Miscellaneous	
TOTAL PER UNIT	
4. Unforeseen contigencies - scrap and rejects - sales costs, taxes - and PROFITS	
TOTAL PER UNIT	
PRICE → TOTAL PER UNIT	

Departmental Budget

On the next page you will see a sample departmental budget. Refer to it until you get a feeling for it's uses. This budget is submitted by each department of the company. Possibly your course could be divided into thirds and every third would be classified as the periods referred to at the top. Each department must plan to get his house in order. If your department approves their budget, they must live within it.

Again refer to the sample department budget.

For an example, the marketing department submitted the sample budget. As you see, they planned to sell 50 units at $2 per unit during the second period, this amounted to $100. During the 3rd period they planned to sell 200 units at $2 per unit and expected to receive $400 in sales. They left the first period blank as they did not expect to receive any sales money due to the company just forming and far from the production phase.

Marketing is not concerned with direct materials, that being the reason for the blank space. The production department would fill in this area as they will be involved with direct materials such as wood, metal, plastics, etc., i.e. any material that is directly used in the product. Production on the other hand, would not fill in sales as it does not apply to their department.

SCHOOIS NAME
COMPANY NAME

Marketing
Department

Departmental Budget

		1st period		2nd period		3rd period	
	item	cost income	sub total	cost income	sub total	cost income	sub total
Sales	50 units @ $2/unit			100			
	200 units @ $2/unit				100	400	100
Direct Materials							
Labor							
Overhead	Advertising	10		10		10	
	50 spots WOCR			10		10	
	Poster Board	5		5			
	Silk Screen Materials	5		3			
	Rubber stamps	2	22		28		20
Totals (costs only)			22		28		20

note: Send carbon copy to Finance & Control and retain original for departmental file.

The labor is the amount planned to be spent on wages during production activities. This should be filled out for periods 2 & 3 as production will probably be in action.

Overhead is anything not directly used by the product itself. Refer to the items mentioned in that space and the understanding should be within your group. Note that each department should keep a copy of the budget and the other one should be sent to F & C. This budget gives your department insights into two areas. How much money can be realized from sales activities and how much will it cost to produce your product.

Record Keeping

Now that you have items that need to be purchased and money coming and going, you will need a means of record keeping. Refer to the sample single entry system

Sample Single Entry System

Accounting Period: 1/1 to 1/31

item	credit	debit
10 bd. ft. pine @ $.50/bf		$ 5.00
1 box 1" wood screws flat head		2.50
1 quart red paint		1.50
Rent		10.00
Heat		5.00
10 doz. units sold John Thomas	$ 45.00	
1 doz. sold Ace Corp.	4.50	
	$ 49.50	$ 24.00

This system allows you to keep your figures straight and keep the company solvent (out of the red). This system will allow your department to plan for the amount of money you will need and when you will need it. This is a simple and effective bookkeeping system. The credit column lists money taken in (money for orders filled, etc.). The debit column lists expenses paid out (supplies, etc.) In the above example you would have a profit for that period of $25.50 ($49.50 from credit minus $24.00 debit equals $24.50). Printed ledger books can be purchased to help keep your company books.

Purchase Control

Your department will have to keep records of purchases and authorize menbers of the company to make purchases. A form called a purchase order is used. The worker or department that needs a supply fills out a purchase order and when it is approved by F & C it is taken or sent to a supplier to be filled.

PURCHASE ORDER

Requested by ______________ Dept. ________________ Date ________

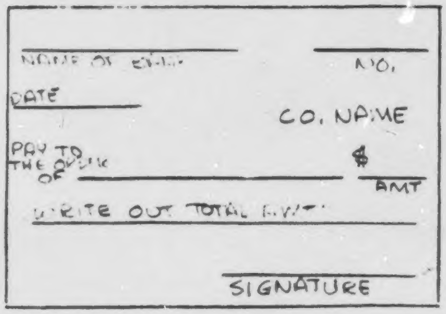
Quantity	Description	Cost

Authorized by ________________________ Total Cost ________

Financial Control

Now that you have money you will want to find a place to store it safely. Your instructor may wish to keep your company money in a safe in which case he may act as a banker. Below are samples of a check, receipt, and checking account book.

Samples



NAME OF [illegible] ________ NO.

DATE ________

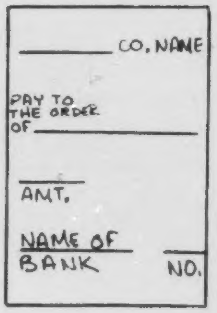
CO. NAME

PAY TO THE ORDER OF ________________ $ ______ AMT

WRITE OUT TOTAL AMT ________________

________________ SIGNATURE

Check



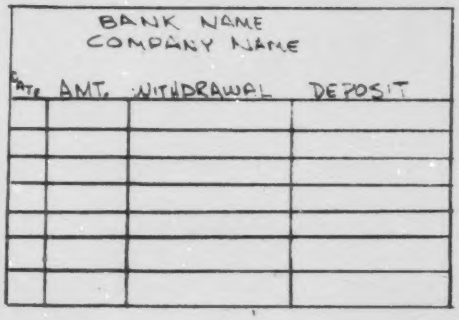
________ CO. NAME

PAY TO THE ORDER OF ________

________ AMT.

NAME OF BANK ________ NO.

Receipt



BANK NAME

COMPANY NAME

DATE	AMT.	WITHDRAWAL	DEPOSIT

Checking Account Book

It may be possible to design a check book that will allow you to combine all three into a neat little pad or booklet. The ideal solution for handling your money would be to open a real checking account at your local bank. The bank manager may show you around the bank and will probably explain how their system of checks works.

Cost Estimating

It will be very important for the finance department to be able to estimate the true cost of a product in order to determine the selling price. Below is a sample cost estimate for a toy top. The standard time is the average time that operation took in time study.

Labor Cost Chart

operation	(A) Wage Rate/min.	(B) Standard Time	Cost A x B
1. cut disc	$ .05	2.00	$ .10
2. sand disc	$ .03	1.00	$ .03
3. cut shaft	$ .03	.30	$ .015
4. drill shaft	$ .03	.30	$ .015
5. sharpen shaft	$ .05	1.00	$ .05
6. cut handle	$ .03	.30	$ .015
7. drill handle	$ .03	.30	$ .015
8. cut string	$ .03	.30	$ .015
			TOTAL LABOR $ .25

Direct Costs			
Labor	$ .25		
Salaries	$ .25		$ .50
Indirect Costs			
Rent	40 % of		
Utilities	Direct		
Maintenance	Costs		$ .20
Material Cost			
From inventory or departmental budget			$ .30
		Total cost	$ 1.00
Profit 50 % (before tax)			$ .50
Manufacturer's Price			$ 1.50

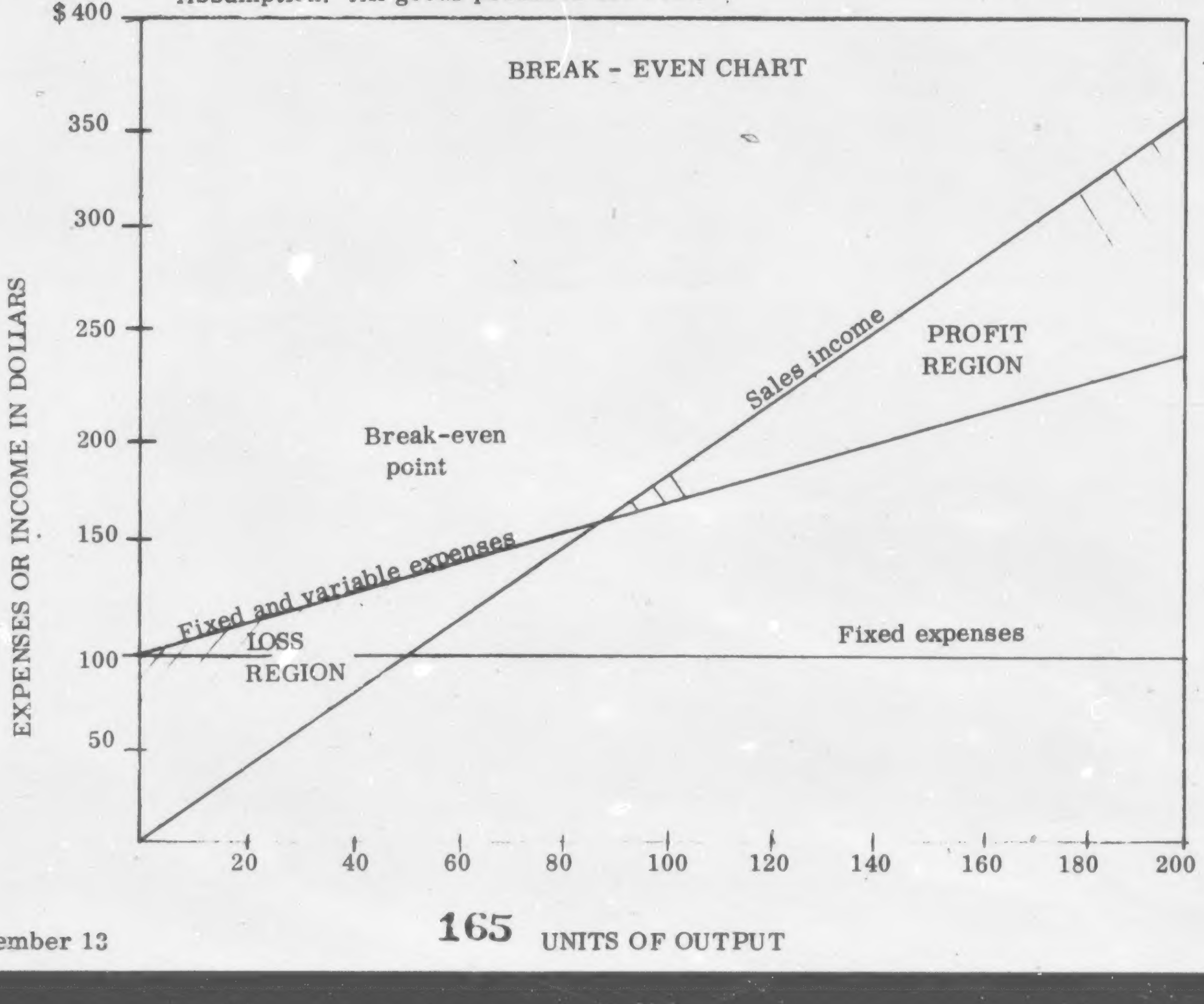
Now you have determined how much the product will cost. How will you know how many you will have to produce and sell to meet expenses? In industry new produce developers want to know how many products have to be sold to break even. A special Break Even Chart is used to determine this point.

Break - Even Chart

Budgetary planning can be more effective by using a break even chart analysis. This analysis will help student companies in estimating and determining production levels and selling prices.

In the chart on the next page a company producing a product with the given cost factors (i. e., fixed costs, which are overhead and labor derived from the departmental budget, totaling $ 90 and variable costs, refers to direct materials used, again from the departmental budget, at 75 ¢ per unit.) would have to produce 90 units at a price of $ 1.75 per unit ($ 350 divided by 200 units) in order to break even. Naturally, they would want to produce above that level to make a profit. Periodic break - even analysis would indicate the need for cost reduction programs or other measures related to budget objectives (or, perhaps, anew budget).

Assumption: All goods produced are sold.



Explanation of Break-even Chart on Page 12

1) Fixed expenses on sample break-even chart: Wages and Overhead. Wages are $8.00; overhead is $19.00. Top of strip is at $27 mark which represents total amount of fixed expenses.

2) Estimated amount of sales was 55 memo pad holders. (Line EE)

3) Materials cost for each unit was found to be $.31. Multiply this cost by the 55 holders to be produced. The cost then is $17.05.

4) On Line E-E, the materials cost of $17.05 was added to the total of the fixed expenses ($27). Point B shows the total of the materials cost and fixed expenses or $44.05.

5) The "Cost and Profit" line is found by going up Line E-E from zero to $44.05.

6) Point A is the point on the "Cost and Profit" line at the top of the shaded area or at the $27 mark. The cost of manufacturing any number of memo pad holders (from 0-60) can be easily determined by following the line drawn between A and B.

7) Divide $44.05 by the number of memo pad holders to be produced (55) to get the cost for each memo pad holder. The $.80 is the cost of wages, overhead, and materials for each holder, when 55 units are produced and sold per week.

8) The company wanted a 25% profit. To find 25% of $.80, multiply:

$$\begin{array}{r} \$.80 \\ \underline{\times .25} \\ 400 \\ \underline{160} \\ \$.2000 \end{array}$$

The profit they wanted was $.20 on each holder.

9) The retail, or store cost is found by adding the cost plus the profit, or $1.00 per holder.

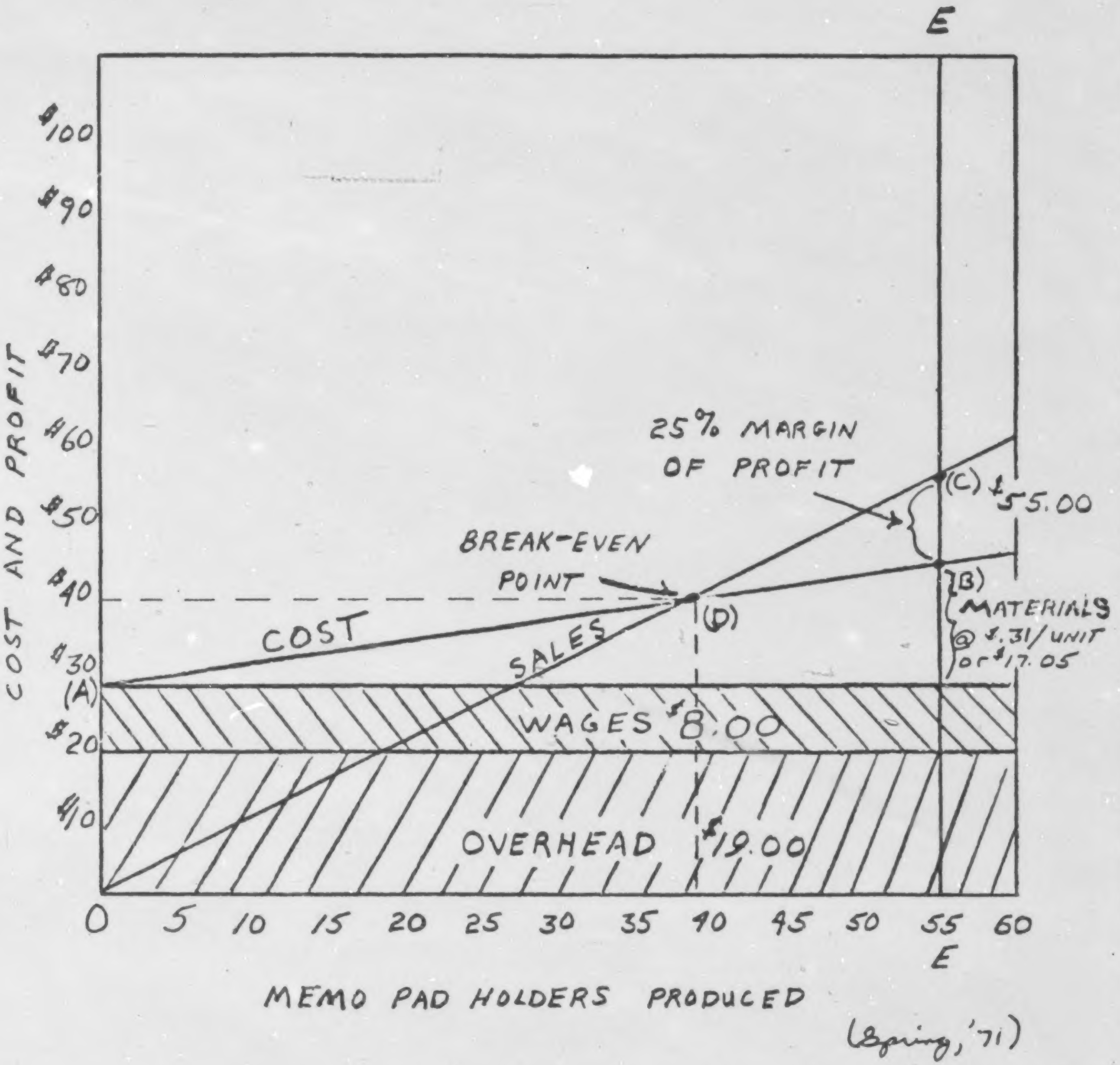
10) For 55 holders, the total retail cost would be 55 X $1.00 = $55. This is Point C on Line E-E directly above Point B.

11) Line OC is the straight line connecting Point O with Point C. This shows the income from the sale of any number of holders from O-60.

12) Point D, where lines AB and OC cross is called the break-even point.

13) When the income from the retail sales of holders equals the cost of producing the holders sold, the company will break even. The chart shows that 38 holders retailing at $1.00 apiece had to be sold before the company started to make a profit. On this short run, each holder sold after the break-even point was reached resulted in a profit for the company until the 55th holder was sold.

BREAK-EVEN CHART
FOR THE
TIGER PAD COMPANY



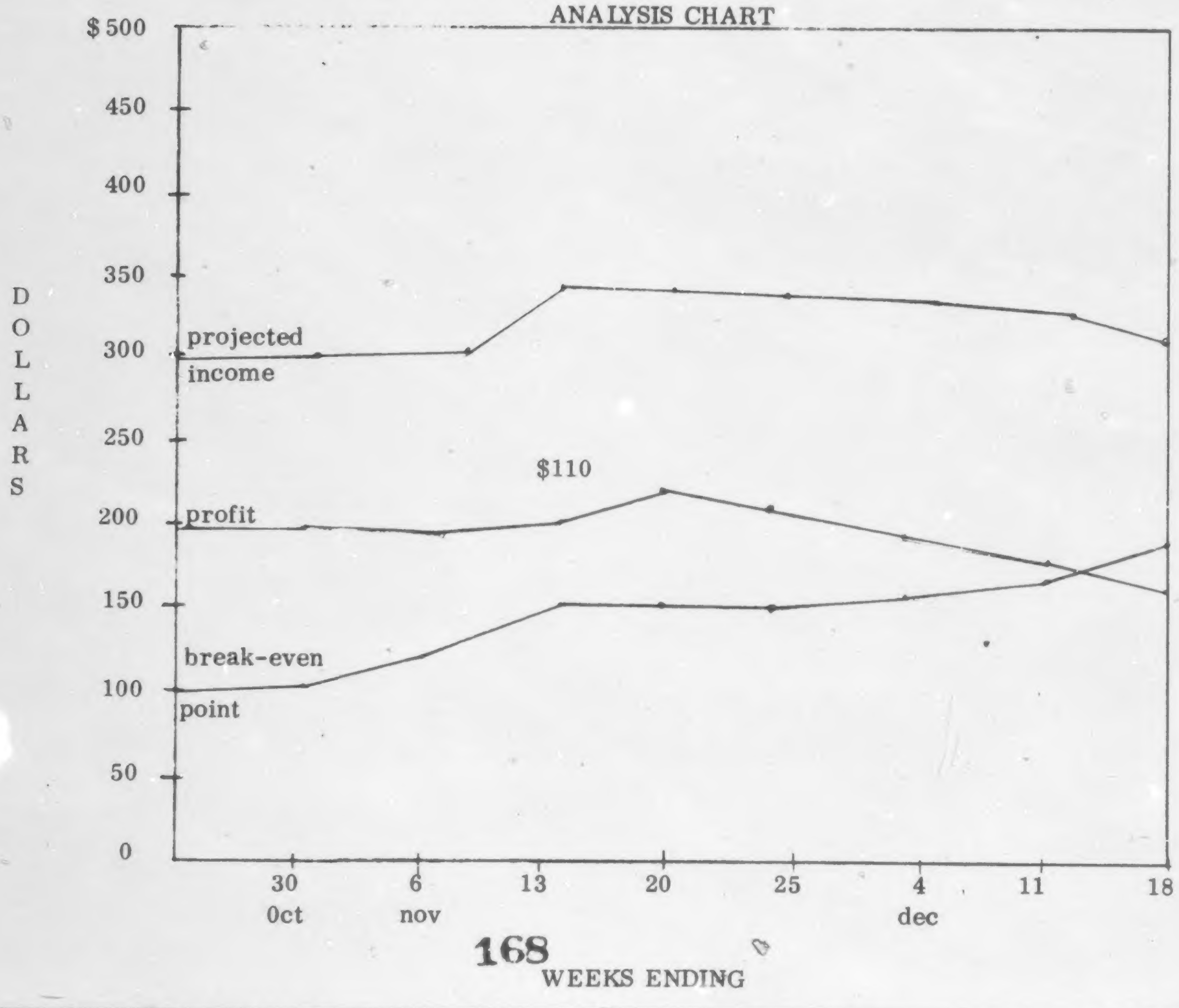
(Spring, '71)

Analysis Chart

Refer to the chart below and notice that the Analysis Chart is a means of noting the progress, week by week, of the anticipated income to be received, profit expected to be made, and the point at which the company will break even.

This information comes directly from each week's break-even chart. If the Finance department posts the Analysis Chart where it is plainly visible, each student on the Board of Directors will gain a little more insight into the financial aspects of the industrial enterprise.

The information recorded on the following chart for the 13th of November comes from the break-even chart on the previous page.



Executive Committee and Board of Directors Meetings

Each time the executive committee and Board of Directors meet your department as well as the other departments will give a report as to how your department is progressing. You may give a report on many items that we have given you a taste of.

These include:
- A pre-budget data
- B stock and how it is selling
- C departmental budget
- D break-even analysis
- E weekly analysis chart
- F estimating product selling price

Any other activities that you take upon yourself should be made known at this time.

The Stockholders Report

Your departments final job will be to prepare a profit and loss statement as part of the liquidation and dissolving of the company. The chart below will give you ample direction.

Profit and Loss Statement of the
UNIVERSAL COMPANY period of Sept. 1 1971 to Jan. 31, 1972

		% of sales
Income from sales:		
Sales (no. of products x price)	$100.	100
Cost of goods sold (materials)	$60.	60
Gross profit	$40.	40
Expenses:		
Labor (wages and salaries)	$15.	15
Overhead (rent, repairs)	$2.50	2.5
Supplies	$5.	5
Total expenses (from gross profit)	$22.50	22.5
Net profit before taxes	$17.50	17.5
Provision for income taxes 22% net profit	$3.85	3.9
Net operating profit	$13.65	13.6

note: income tax is paid to school or selected charity as necessary cost of doing business.

After you have discovered the net operating profit, you can now recall all stocks and prepare to pay dividends.

What Happens If Your Sales Do Not Equal Expenses?

If a corporation can not meet its expenses it must declare Bankruptcy. This is a legal device that allows a corporation to dissolve by selling all materials and equipment and after paying stockholders their original investment the remaining money is divided among creditors.

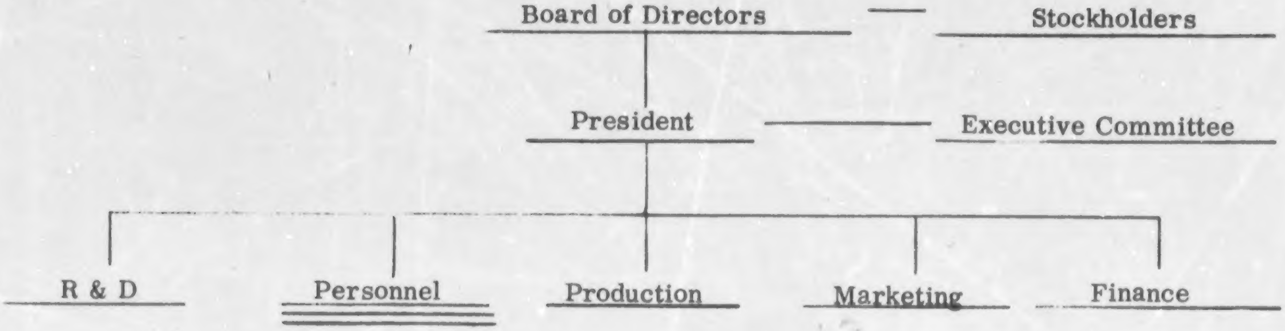
your student guide to

PERSONNEL ADMINISTRATION

staffing the company

Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York
College at Oswego

PERSONNEL DEPARTMENT



What Does The Personnel Department Do?

Your department's job during the ten weeks will be to manage people. Unlike the information and materials of other departments, your raw material comes in many different forms. Each person has different backgrounds, abilities and feelings. For production efficiency this variety of human characteristics must be worked into, an at times rigid, framework of the corporation. In order to do this successfully you will have to be very good at seeing these individual differences and deal with them carefully.

Your first job was to gather as much data about each member of the class as possible. Industry uses employment forms, to gather information about past employment, education, and skills. Interviews add to this information by letting personnel talk directly with prospective employees. This does not insure that all round pegs will find round holes, but the more information you can gather about each person the greater the chances of fitting people to jobs they will do well.

What Do I Do?

As a member of the personnel department your first task is to supply personnel (workers) for the other departments. How will you do this? Will you assign certain people to a specific department or is their an organized way of job assignments? If you were in a real industry what way do you think would be successive?

Industry tries to get the right man for the right job. While you may already know a lot of the students in your class and they may be good friends, industry is to big to know all its people this way. This will be your first job, to get to know the people that are going to be employed by your company.

Industry goes about this by using job applications and interviews. It is your job to try to get the right man for the right job. Here is a sample application form for your reference. All the questions on the application will probably not be needed in your situation, but others may. By using this job application as a guide develop your own job application to better fit your class company needs.

Reminder: As your class company progresses jobs may change and other areas may slack off and transfer employees to other departments. You must be ready to forsee and handle this situation.

Organizational Charts

After placing all your employees into their departments it would be a good idea to make up an organizational chart like the one at the beginning of this module. You may want to add names of all the employees under each department they belong to.

Time Cards

How are you going to keep track of when the employees of your company come to work? What happens when they come to do extra work after class? Companies do not have people standing at the door checking attendance. This is not efficient and wastes time and man power. Companies get around this by using time cards. These cards have the name of the worker, the week, the amount he makes and also records by the use of a punch clock the date and time the worker punches in or out. He would do this in the morning, lunch time, and when he leaves at night. This is an accurate record of the time he spends in the factory or when ever he works.

There is a sample,included in this module, of a time card that can be used . There is only one problem involved. Since it is not practical for you to buy a punch clock for your company, how are you going to solve the problem of recording the date and the time? .... Yes, you are right.

Internal Relations

As a menber of the personnel department you must keep the members of your company happy. It is your job to keep the relationship between the company and the workers on good terms. You can negotiate (bargain) with your workers for things they may want. In big companies they have suggestion boxes that can be used for these ideas. These suggestion forms may be as simple as the one below.

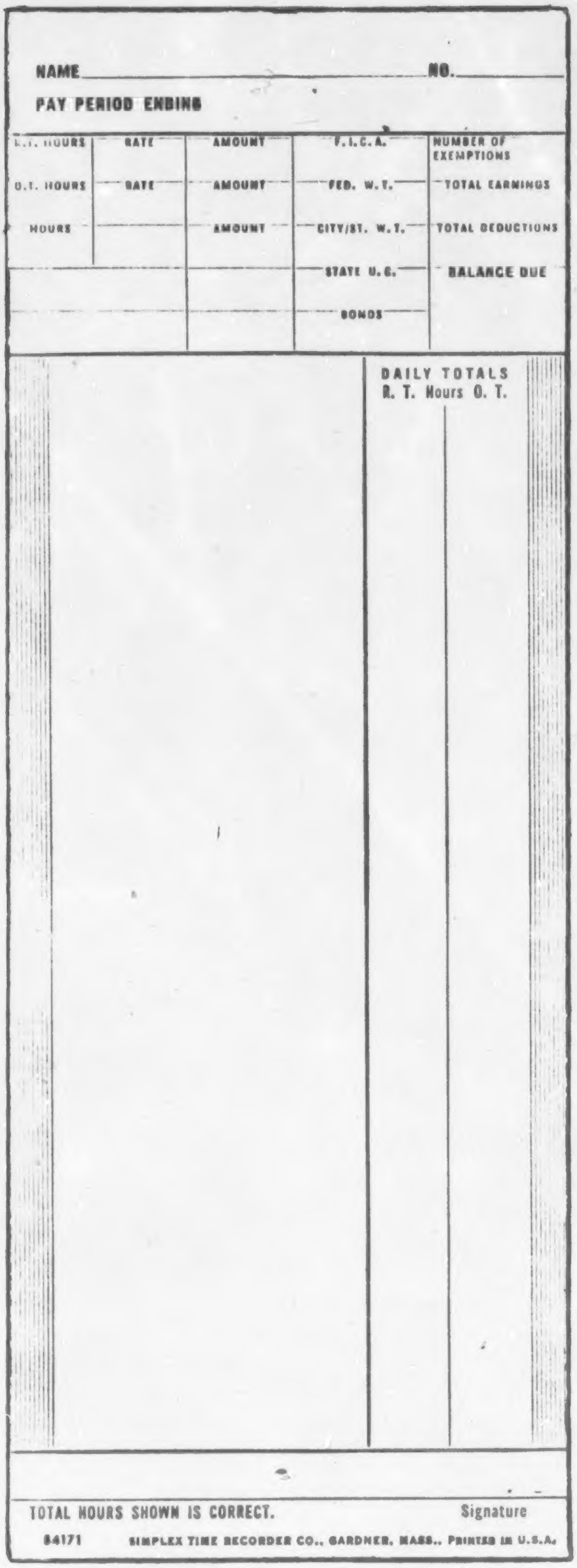
Suggestion Form

Name (optional) ______________________________ Date ____________

Suggestion ____

____

SAMPLE TIME CARD



NAME______________________________ **NO.**__________

PAY PERIOD ENDING

R.T. HOURS	RATE	AMOUNT	F.I.C.A.	NUMBER OF EXEMPTIONS
O.T. HOURS	RATE	AMOUNT	FED. W.T.	TOTAL EARNINGS
HOURS		AMOUNT	CITY/ST. W.T.	TOTAL DEDUCTIONS
			STATE U.C.	BALANCE DUE
			BONDS	

DAILY TOTALS
R. T. Hours O. T.

TOTAL HOURS SHOWN IS CORRECT. Signature

84171 SIMPLEX TIME RECORDER CO., GARDNER, MASS., PRINTED IN U.S.A.

APPLICATION FOR EMPLOYMENT

Industrial Arts Department
Teacher: ______________

____
(School)

(Print) ______________ (Last Name) (First Name) (Initial) Age ____ Grade ____ Homeroom ______

Address ______________ Telephone ______________ Brothers ____

______________ Home Workshop ___Yes ___No Sisters ____

Mother's Name ______________ Occupation ______________

Father's Name ______________ Occupation ______________

Physical Limitations ______________

What do you want to do after graduation? ______________

BACKGROUND

Other industrial arts courses completed ______________

What is your favorite academic course? ___Math ___History ___English ___Science ___Other (specify)______

Do you like to use tools? ___Yes ___No Which tools? ______________

Do you like to use machines? ___Yes ___No Which machines? ______________

Can you use a typewriter? ___Yes ___No Do you have a job? ___Yes ___No What? ______________

Do you like to draw? ___Yes ___No Would you like to sell? ___Yes ___No

Do you like to do math? ___Yes ___No Which do you like best? ___Woodworking ___Metalworking ___Other______ (Specify)

Do you like to talk to others? ___Yes ___No Do you like to work alone? ___Yes ___No

Do you like to write? ___Yes ___No Do you like to work with others? ___Yes ___No

Which job would you like best? ___Worker ___Assistant ___Department Head

Sports, Hobbies ______________

Clubs, Groups, Honors ______________

(Date)______ I DECLARE THAT THE INFORMATION SUPPLIED ABOVE IS CORRECT AND TRUE. (Signed)______________

DO NOT WRITE IN THE SPACE BELOW AT THIS TIME

PLACEMENT PREFERENCES

PLEASE INDICATE YOUR EMPLOYMENT INTERESTS. NUMBER (1, 2, AND 3) IN ORDER OF PREFERENCE.

LEVEL OF RESPONSIBILITY	F & C	PERSON.	MARKT.	ENGNR.	PROD.
DEPT. HEAD	___	___	___	___	___
ASST. DEPT. HEAD	___	___	___	___	___
STAFF	___	___	___	___	___

APPLICANT WILL NOT USE SPACE BELOW

REMARKS ____

____

____

DATE __________ SIGNED ____________________

WEEKLY SCHEDULE

PERIOD	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1					
2					
3					
4					
5					
6					
7					
8					
9					

See if you can come up with some more ideas to put on the form to make it better.

Grievance Forms

Along with internal relations and suggestions there must be a way for an employee to complain. He may not like his job, his foreman, or sone other thing about the company. One such way of complaining is by using a grievance form. This permanently records your complaint and you receive a copy of what was done about your complaint.

Labor Contracts

When you go to work for a company you and the company must agree on things like wages, hours, overtime, holidays and other details which effect your job. Gor small companies that may hire two or three people this can be done on an individual basis, but for companies that hire twenty or thirty to a couple of thousand people this is not practical. Their must be a set contract between the company and you that is written down.

In earlier years in large companies, a single person may not get what he wanted. Some companies would fire a person if he wanted a raise or complained about something. Workers got tired of this and would join together and ask for raises and holidays so they would not get fired. This was the start of modern day unions.

Unions are made up of the workers not only in your company, if it has a union, but in many companies. The teamsters are a big and powerful union. Can you name others? The reason for unions is that a few people can bargain with the company on your behalf. Instead of thousands of people trying to argue for raises or other things from the company, a few people that are elected by you bargain in your behalf.

Some companies do not need unions. Eastman Kodak in Rochester, N.Y. employ thousands of people who are not in a union. Kodak has a very effective and efficient personnel department who are interested in their employees and work for them. They have movies at lunch time, a bowling alley, pool room, pistol range and many other recreational facilities for their employees. You can look at many companies today that have unions and are not as concerned with their employees.

A sample contract is presented on the next page. It is an agreement between the Universal Toy and Game Company and The United Game Workers. This agreement was formed and used in a school situation.

Sample contract:

AGREEMENT

between
Universal Toy and Game Company
and . . . .
The United Game Workers

This agreement dated January 1, 1971 between the Universal Toy and Game Company, hereafter called the Company, and the United Game Workers, hereafter called the Union, will be in effect for the entire school term.

Conditions:

The Company agrees to honor the right of workers to collective bargaining of all issues through the elected representative of the Union. The Company representative agrees to meet with this Union Shop Steward when ever necessary to settle grievances presented by the Union.

The Union agrees not to strike or in any other way disrupt the efficient operation of the Company for the period of the agreement. The Shop Steward further agrees to try to settle individual employee disputes before resorting to negotiations with the Company representative.

In the case of deadlock disputes between the Company and the Union both parties agree to submit to binding third party arbitration by the class instructor.

Wages:

The company agrees to pay hourly workers at the rate of 10¢ per hour during regular class sessions and a rate of one and one half times this or 15¢ per hour for overtime worked outside of class time.

Agreement Signed January 1, 1971
Company ______________________
Corporate Secretary

Union ______________________
Shop Steward

GRIEVANCE FORM

Department ______________________________ Date of Request ____________________

Nature of Grievance:

Signed ____________________ Occupation ________________________

FOREMAN'S DISPOSITION:

______ Granted ______ Rejected ______ Compromised ______ Ref. to Supervisor

REMARKS:

Date ____________ Signed ______________________Foreman

PLANT SUPERINTENDENTS DISPOSITION: (2nd step)

______ Granted ______ Rejected ______ Compromised ______ Ref. to Supervisor

REMARKS:

Date ____________ Signed ______________________ Supervisor

MANAGER'S DISPOSITION: (3rd step)

______ Granted ______ Rejected ______ Compromised ______ Ref. to Supervisor

REMARKS:

Date ___________ Signed ____________________ Manager

Safety Program

Your instructor will make sure that people who operate machines know how. You will make sure that machines and other plant equipment are safe. A daily check list drawn up with your instructor's aid should be completed. Report all items found to be unsafe. A good list of safety rules, such as eye protection must be worn in the shop at all times, is another must. Most industrial arts shops have such a list posted. No rule is going to stop an accident unless it is enforced. Until a safety program is planned and machine operators are qualified to run equipment properly, you are not ready to produce.

Job Training

Finding a person for a job is only part of the larger task of filling a work slot in the company. In order for a worker to be efficient he must understand what he is expected to do. Your department is responsible for training workers for their jobs. To do this you will have to have a description of what each job involves. This is called a job description.

Job Description Card

Department: Production JOB TITLE: Drill press operator STATION: 3

JOB IDENTIFICATION: Sets up hole saw and fixture to cut round disc for top. (part #2) Usually inspects own work. Places finished part in box for transportation.

JOB REQUIREMENTS: Must be able to safely set up and operate 14" drill press. Must be capable of reading a rule to 1/16" and have good manual dexterity.

With such a job description you will know how to train a worker to fill each job. It may only be necessary to give the worker a written Operation Sheet which he can follow to perform his work.

External Relations

This area of your responsibility deals with the role of your company outside the plant. Public Relations is very important, after all it is the public who buys your products. It is important that your company maintains a good image in the eyes of the public. Keep people informed of what your company is doing. The school newspaper or local newspapers will welcome news releases. Encourage and set up guided tours of interested people. Bulletin boards and display cases in the school can be used to show other students shat you are doing as a company. Many industries have company bowling and baseball teams which not only foster better employee relationships outside of the company but create good images of of the company as well.

A corporation is after all a part of the community and your goal as director of External Relations will be to make your companies role a beneficial one.

Evaluation

You as part of personnel should come up with some way of evaluating your workers. In a company this is done to see if they are working up to par or to give bonuses to outstanding workers. Here in your company you must evaluate the workers as a quide to see if they have been active in the company. You can make up a questionaire for this that your workers can fill out. Here are some sample questions other students have used on their evaluation sheets.
Does he work safely?
Does he get along with others?
How well and how fast does he do his job?
Does he have to be told what to do all the time?

There are many more that can be used. A good idea is not just to use yes or no for answers, but put it on a scale of one to five, where one is always and five may be never.

your student guide to

MARKETING

selling the product

PUBLIC
AUCTION

Developed by the participating Student Teachers of the Fall 1971 Pilot Program
Department of Industrial Arts and Technology
State University of New York

College at Oswego

What Does The Marketing Department Do?

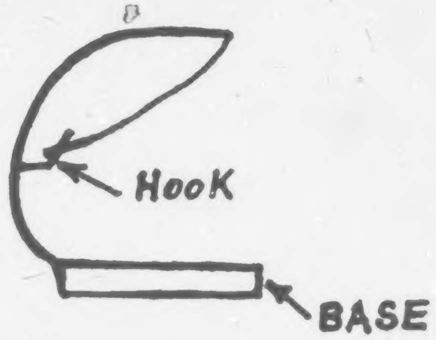
The answer, of course, is to sell the product. In order to do this effectively your department is going to be involved in many activities, market testing, market identification, advertising, packaging, and sales distribution.

Many people have heard of the Edsel. No one is quite certain why it did not sell. In order to avoid marketing failures such as this any company wants to know how a product will sell before it is committed to production. The first job of any marketing department is to gather such basic information on the buying preferences.

The Market Survey

Determine what your market is. Below is a sample market survey which is designed with questions to find out who is going to buy your product.

Swing Ring Company



Sample Questions:

1. What color would you like it?
   A) Red B) Blue C) Black D) Yellow
2. Would you like it more than one color? yes ___ no___ If yes circle two colors: Green, White, Black, Red, Blue, Yellow.
3. Would you buy it? yes ___ no ___ If yes how much would you be willing to pay? A) $1.00 B) $1.25 C) $1.50 D) $2.00
4. What kind of base should it have? A) Metal B) Wood C) Plastic D) Ceramic E) Other.

Now you have an idea of who you are selling to, but how many will buy your product?

The Sales Forecast

Corporations spend millions of dollars each year trying to predict sales. Television networks and advertising agencies account for millions more in dollars spent to find out how many people like one show or product. Many books have been written on the subject and a branch of mathematics deals with such data. Here are a few techniques you may be able to use:

Projection: If you have found that a certain part of your original survey group has followed a trend, all the freshmen girls polled said they would buy, you need only determine the total number of freshmen girls to predict that segment of your sales.

Will this always hold true? You can see the importance in having your sample group of what ever number be as representative as possible of the whole group you wish to test.

Interview: Talking to potential customers as well as local retail store owners will give you valuable information on buyer taste. If you can find a friendly store owner he may be able to give you sales facts on a product similar to yours.

Orders: Preproduction order taking will give you an idea of how many products you will be able to sell. It may only be necessary to have a partial advance sale to predict total market size.

One important thing to remember, Market Research is only valuable if the results are available early enough to aid in the design and setting of production quantity. Finding out when the product is on sale is costly.

ADVERTISING

How many times have you been effected by advertising? Did you ever buy something because of a catchy TV ad? Do you know what General Electric is? Your goal in developing advertising for your company will be these two things.

1. Make people aware of your company and what it makes.

2. Persuade prospects to buy your products.

Many devices are used by industry to create an image that people will remember. Catch phrases, "Ford has better ideas," "GM mark of excelence," stick with people. Trademarks are especially good in getting people to recognize your company. See how many of the companies on the next page are quickly identified.

The second goal of advertising is usually accomplished by appealing to emotional or logical needs of your prospect. Look at a few ads in a magazine or newspaper and see if you can figure out the appeal. For example, DO YOU HAVE BAD BREATH? appeals to fear. KIDS, BE THE FIRST ON YOUR BLOCK, the desire to be special. USUALLY $29.95, BUT THIS WEEK ONLY...the desire to save money.

To get your message to the people you want to hear or see it, requires careful choice of Media. A few that are available are: Radio and TV, Newspapers, Outdoor Signs and Billboards, Posters and Window Displays, Direct mail (free samples, leaflets and catalogs) and many more you could add. The important thing to remember is that each medium has a different cost and reaches a different audience. Choose the one that will reach your market for the best price. Write your copy using positive selling points and factual information.

Name Styles

Kellogg's

ALCOA

LIFE

Name and Trademark

ROTO-ROOTER
SEWER-DRAIN SERVICE

AMERICAN PLYWOOD ASSOCIATION

7A
THE SEVEN ARTS SOCIETY
132 West 43rd Street, New York 10036

Company Initials

IH

RCA

AC

GE

GM
MARK OF EXCELLENCE

VW

3M COMPANY

IBM.

Symbols

PACKAGING THE PRODUCT

Did you ever buy a record album because it had a good looking jacket? When your mother buys groceries, does a delicious looking picture of a cake on the package influence her decision to buy? Would your younger brother buy a model car if the box didn't have an attractive picture of the finished product? The purpose of a package is to protect a product between factory and consumer. The fact of the matter is, however, that packages are also the first impression the customer has of your product. How the packages look when displayed in the school store or "point of purchase" is a form of advertising.

Look at some of the ways modern industry packages products and you will find many ideas you can adapt. Plastic bubbles can be made in most I.A. Shops. Plastic wrap can be head sealed with an iron. Plastic bags are available in a wide variety of sizes and shapes. Paper and cardboard can be die cut to form a wide variety of boxes and bags. Perhaps you can sub-contract the cutting and printing of your package to a Graphics Shop or Art Department.

Remember the time to consider the package design is during the engineering of the product itself.

DISTRIBUTION

How does industry get its products to the consumer?

1. Direct selling to consumer	This method gives the manufacturer the full retail price, but he must consider the cost of a sales department, and retail outlets. Selling may be conducted on a house to house basis. Examples: Avon (door to door) Singer (retail stores) Milk (route sales)
2. Selling direct to stores	This method requires the manufacturer to be his own representative. Examples: Bread (in supermarkets) Clothing (in department stores)
3. Consignment Selling	This method places the products in the hands of independent salesmen or store owners at no cost. The manufacturer is paid for the items sold and the remainder is returned by the selling agent. Examples: Novelties (at fairs) Girl Scout Cookies

4. Selling by Mail	Direct selling to customers by mail requires a great deal of advertising often by printed catalogs. The manufacturer must have the additional funds to buy ad space, mail promotion material, as well as package and mail orders to the customer. Examples: Records (through clubs) New Process Company (clothing) Hudson Vitamins
5. Selling to a jobber	Jobbers are wholesale distributors who handle large quantities which are purchased at reduced prices. The jobbers have far-reaching sales outlets to retail stores. Both the jobber and the manufacturer hope to make profit on quantity sales. Example: Candy and Cigarettes
6. Franchise outlets	This is a new method of distribution in which the manufacturer sells the rights to distribute his merchandise to an independent merchant. The franchise owner provides the cost of maintaining the retail outlet and most supplies. Since the independent operator has a strong stake in sales he is profit conscious. Example: Radio Shack Gas Stations Colonel Sanders Chicken

Whether or not the product to be sold will be sold to a Wholesaler, Manufacturers Agent, Selling Agent, Retailer, by Selling Consignment or directly to the consumer, the manufacturing organization must have a salesman to sell people on the product. Why my brand "Y" is better than his brand "X".

The student company will probably concentrate its efforts selling directly to the consumer. It is possible to sell to a retailer, but probably at a lower profit.

Pre-sales is a method of selling a product that can be quite successful with student companies. This is a method by which an order is taken and a down payment paid prior to manufacture of the actual product. When the product is complete the remainder of the price is paid to the company by the customer and he in turn gets his product.

Suggestions for sales in a student enterprise:

1. Set up a booth in the cafeteria with the product being demonstrated. Have students take orders.
2. Demonstrate product in study halls and take orders.
3. Demonstrate product at faculty meetings, take orders.
4. Advertise company tours, take groups of students and faculty on plant tours and at the end ask them for orders.

There are three parts to a successfur sales pitch.

1. Approach-talk to the customer, use his name, do not use sympathy as a motive.
2. Demonstration-now bring out the product, hand it to the customer and let him examine it. Answer his questions and accept all critisms.
3. Close by asking for his order in a way he cannot say no.

"Good Evening, Mrs. Smith"

There are three parts to any sale. 1) the approach; 2) the demonstration; 3) the close.

The approach: Ask for the prospect by name if you can. If I am Mrs. Smith and the salesman asks for the "lady of the house," I am not in. If he asks by name I'm curious and wonder who he is.

Introduce yourself and explain briefly what your company is doing. Avoid appeals for sympathy. The customer should buy on merit not to support a "Good Cause."

Get your prospect concerned about the conditions your product was designed to help. "Mrs. Smith, our company decided that we could best help our customers with a product that will make the most attractive home more attractive."

The demonstration: Now you have curiousity. Now and only now bring out your product. Hand it to her as if you expect her to take it. Your customer will reach out and take it every time.

Before your customer has a chance to say a word give them a benefit. "Mrs. Smith, see how effectively our product is designed." Don't be discouraged by a prospect's questions and criticism. Answer questions honestly and with only the facts necessary. Too mcuh talking kills the sale. Save other benefits to help erase doubts if necessary.

The close: You must ask for the order. Don't wait for the prospect to ask. Give the prospect two choices -- either of which mean an order. "Do you think one will be enough, Mrs. Smith, or would you like two?" This is called the split decision. Never give a customer the question in a way that she can say no. Conclude your sale or order, thank them, and go on to your next prospect.

Be sincere. Be yourself. Be confident in your product. This advice has been proven by 100,000 young people each year in Junior Achievement companies much like your corporation.

Excerpted from Junior Achievement
Company Manual JA50